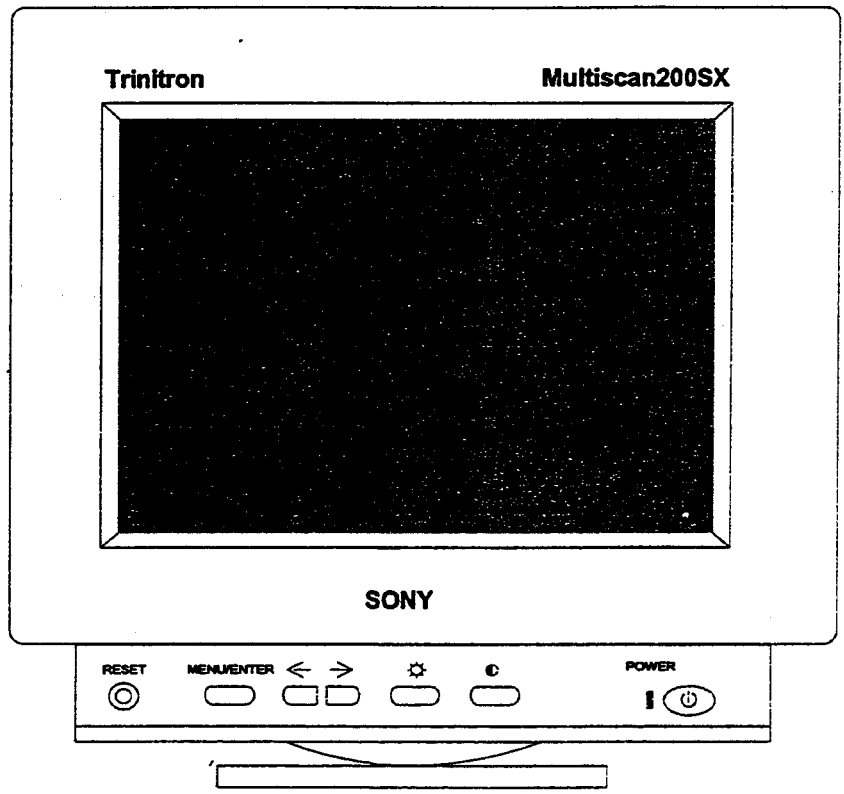
17V(CPD200SX)

Color Computer Display Service Manual



Safety Standards and Approvals

- This monitor complies with DHHS Rules 21 CFR Subchapter J Applicable at date of manufacture.
- Certified to comply with the limits for a Class B computing denice pursuant to part 15 of FCC rules
- Please refer to instructions included FCC motice in the user's manual id this equipment is suspected of causing interference to radio reception.

Important Safety Notice

This equipment contains special components which are important for safety. These critical parts should only be replaced with the parts specified by the manufacturer in order to prevent X-radiation, shock, fire or other hazards. Do not modify the original design.

Preface
Before You Start

General Safety Precautions

1. Use an isolation transformer in the power line and AC supply to troubleshoot.
2. When servicing, observe the original lead dress, especially in the high voltage circuits. If a short circuit is found, replace all parts which have been overheated or damaged.
3. Before turing the display on, measure the resistance between B+ line and chassis ground. Connect the negative side of an ohmmeter to the B+ lines and the positive side to chassis ground. Each line should have more resistance than the following specifications:

B+ Line	Minimum Resistance
+177V	127.35KΩ
+75V	50.58KΩ
+15V	22.23KΩ
-12V	13.18KΩ
+6.3V	3.45Ω
+5V	1.35KΩ

4. Potentials, as high as 26kV are present when this display is in operation. Operation of the display without the rear cover involves the danger of a shock hazard from the display power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment. Always discharge the anode of the picture tube to the display chassis before handling the tube.
5. After servicing, be sure to check the items listed in the Safety Checkout, below before returning the serviced unit to the customer.

Safety Checkout

The following checks must be made after correcting the original service problem and before the unit is returned to the customer.

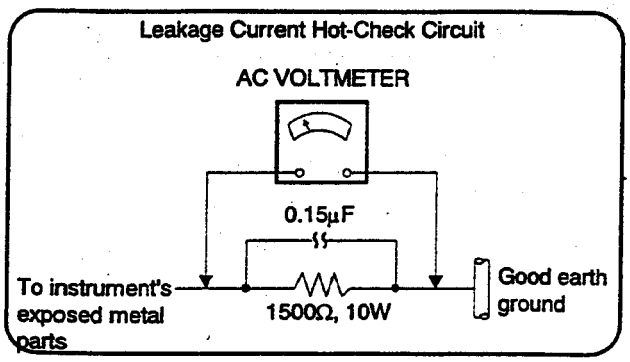
1. Check the area of your repair for unsoldered or poorly soldered connections. Check the entire board surface for solder splashes and bridges.
2. Check the inter board wiring to ensure that no wires are pinched or coated with high-wattage resistors.
3. Check that all control knobs, shields, covers, ground straps and mounting hardware have been replaced. Make absolutely sure you have replaced all the insulators.
4. Look for any unauthorized replacement parts, particularly transistors, that may have been installed dueing a previous repair. Point them out to the customer land recommend their replacement.
5. Look for parts which, though functioning, show obvious signs of deterioration. Point them out to the customer and recommend their replacement.
6. Check the line cord for cracks and abrasion. Recommend the replacement of any such line cord to the customer.
7. After making any repair, check the B+ and HV to see whether they are at the values specified. Make sure your instruments are accurate; if your HV meter always shows a low HV, check the meter to ensure it is not malfunctioning.
8. Carry out the leakage current checks as detailed below overleaf.

Leakage Current Cold Check

1. Unplug the AC cord and commect a jumper between the two prongs on the plug.
2. Turn on the display power switch.
3. Use an ohmmeter to measure the resistance value between the jumpered AC plug and each exposed metallic cabint part on the display, such as screwheads, terminals control shafts, etc. When an exposed metallic part has a return path to the chassis, the reading should be between 240k and 5.2M. When exposed metal does not have a return path to the chassis, the reading must be.

Leakage Current Hot Check

1. Plug the AC cord into the AC outlet. Do mot use an isolation transformer for this check.
2. Connect a 1.5k, 10 watt resistor in parallel with a 0.15F capacitor between each exposed metallic part on the set and a good earth ground (see How to Find a Good Earth, below) as shown in the diagram below.



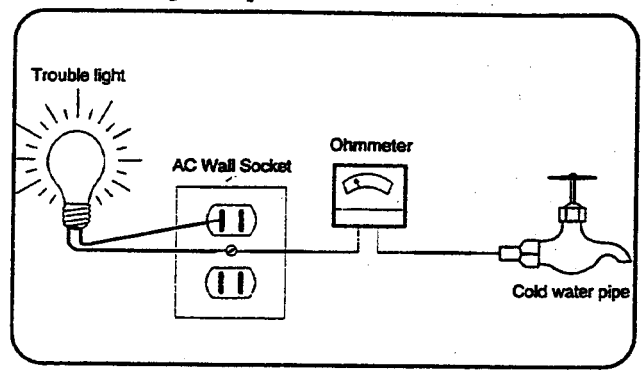
Example of Leakage Current Hot-Check Circuit

3. Use an AC voltmeter with 1000 ohms/volt or more sensitivity to measure the potential across the resistor.
4. Check each exposed metallic part, and measure the voltage at each point.
5. Reverse the polarity of the AC plug in the AC outlet and repeat the above measurements.
6. The potential at any point should not exceed 0.75 volt RMS. A leakage current tester (Simpson Model 229, RCA WT-540A or equivalent) may be used to make the hot checks.

Leakage current must not exceed 0.5 milliamp. If a measurement is outside of the specified limit, there is a possibility of a shock hazard and the monitor should be repaired and rechecked before it is returned to the customer.

How to Find A Good Earth

A cold water pipe is a guaranteed earth ground; the cover plate retaining screw on most AC outlet boxes is also at earth ground. If the retaining screw is to be used as your earth ground, verify that it is at ground by measuring the resistance between it and a cold water pipe with an ohmmeter. The reading should be zero (0) ohms. If a cold water pipe is not accessible, connect a 60-100 watt trouble light (not a neon lamp) between the hot side of an AC power receptacle and the retaining screw. Try both slots, if necessary, to locate the hot side of the line. The lamp should light at normal brilliance if the screw is at ground potential



How to Check for Earth Ground

Table of Contents

Section 1.
Product Specification

1.1.Monitor Control Locations & Functions 1-1
1.2.Product Overview 1-2
1.3.CRT Characteristics 1-2
1.4.Power Specifications 1-2
1.4.1.Power Supply 1-2
1.4.2.Power Management 1-2
1.5.Video Specifications 1-2
1.5.1.Video Amplifier Performance 1-2
1.5.2.Video Input Signal Characteristics 1-2
1.6.Sync Input Signal Characteristics 1-2
1.6.1.Separate Sync 1-2
1.6.2.Composite Sync 1-2
1.6.3.Sync On Green 1-3
1.7.Environmental 1-3
1.7.1.Temperature/Humidity/Altitude 1-3
1.7.2.Vibration Test 1-3
1.7.3.Drop Test 1-3
1.8.Preset Timing Modes 1-3

Section 2.
Disassembly Instructions

2.1.Removing the Rear Cover 2-1
2.2.Internal Disassembly (Right side) 2-1
2.3.Internal Disassembly (Left Side) 2-1
2.4.Removing the Neck Board & Main Board 2-2

Section 3.
Theory of Operation

3.1.Switching Power Supply 3-1
3.1.1.Auto-degaussing , ... 3-2
3.1.2.Suspend Mode Operation 3-2
3.2.The Deflection Circuit 3-2
3.2.1.IC301 LM1291 Video PLL System for Continuous-Sync 3-2
3.2.2.IC301 LM1291 Pin Descriptions 3-4
3.2.3.IC302 LM1295 DC Controlled Geometry Correction System 3-5
3.2.4.IC302 LM1295 Pin Descriptions 3-5
3.2.5.Vertical Deflection Circuit 3-6
3.2.6.Geometry Correction Circuit 3-7
3.2.7.Structure of Horizontal Deflection Circuit 3-7
3.2.8.X-RAY Protection Circuit 3-12
3.2.9.The Focus Circuit 3-12
3.2.10.Horizontal linearity and CS Switching 3-12
3.2.11.The Misconvergence Circuit 3-12

3.3.Video Amplifier 3-12
3.4.Microprocessor And Sync Processing 3-13

Section 4.
Setup Adjustments

4.1.Preparing the Display for Adjustment 4-1
4.1.1.Test Equipment Required 4-1
4.2.Adjustment Procedures 4-1
4.2.1.Adjustment Sequence 4-1
4.2.2.Preset Timings Used During Adjustment 4-1
4.3.High Voltage Verification 4-2
4.4.X-ray Protection Check 4-2
4.5.G1 Voltage Adjustment 4-2
4.6.Background Brightness Setting 4-2
4.7.Screen Brightness Adjustment 4-2
4.8.Magnetic Field Configuration 4-3
4.9.Raster Center Verification 4-3
4.10.Tilt Verification 4-3
4.11.Focus Verification 4-3
4.12.Color Misconvergence 4-3
4.13.Primary Test Mode Performance Adjustments 4-3
4.14.Performance Adjustments for All Preset Modes 4-3
4.15.Image Performance Verification 4-4
4.16.Uniformity Verification 4-4
4.17.Brightness Verification 4-4
4.18.Display Size Stability 4-4
4.19.Color Purity Verification 4-4
4.20.Video Noise 4-4
4.21.Power Saving Check 4-4
4.22.DDC 1/2 Data Writing 4-4

Section 5.
Troubleshooting

5.1.No Display at Power-on 5-1
5.2.No X-ray Operation 5-2
5.3.No Video Operation 5-3
5.4.Poor Vertical Linearity 5-4
5.5.Poor Horizontal Linearity 5-5
5.6.Poor Uniformity 5-6
5.7.Tilted Display Area 5-7
5.8.Misconvergence 5-8
5.9.Poor Regulation 5-9
5.10.Poor Focus 5-10
5.11.Poor Geometry Distortion 5-11

Section 6.
Printed Circuit Boards

6.1.Main Board 6-1
6.2.Neck Board 6-2

6.3.PCB Wiring Connection 6-3

Section 7.
Schematic Diagrams

7.1.Neck Circuit Diagram 7-1
7.2.MAIN Circuit Diagram 7-1

Section 8.
Mechanical Parts

8.1.Exploded View 8-1
8.2.Key to Exploded View 8-2

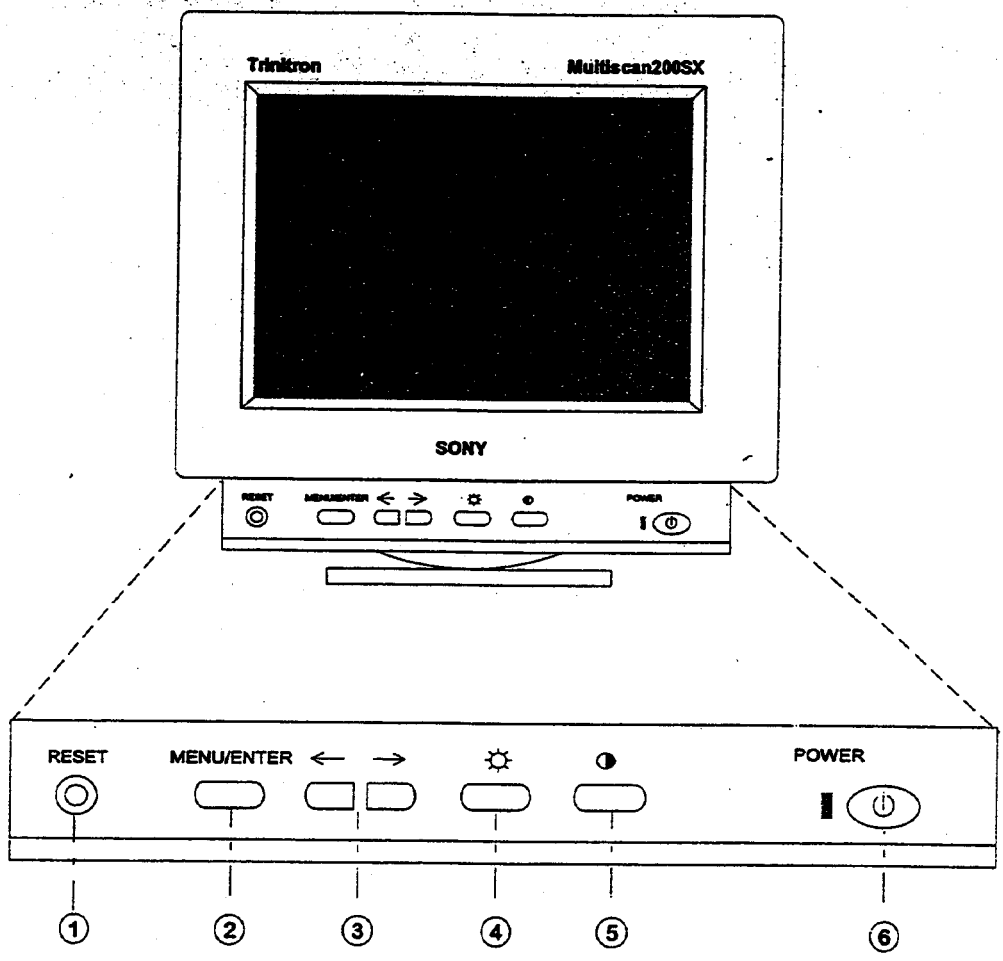
Section 9.
PCB Component List

9.1.Explanation of Parts Listing 9-1
9.2.RMH-7T11 Component List 9-1
9.2.1.Main Board 9-1
9.2.2.Neck Board 9-7
9.3.RMH-7T12 Component List 9-9
9.4.RMH-7T13 Component List 9-9

Section 1.
Product Specification

1.1. Monitor Control Locations and Functions 1-1
1.2. Product Overview 1-2
1.3. CRT Characteristics 1-2
1.4. Power Specifications 1-2
1.5. Video Specifications 1-2
1.6. Sync Input Signal Characteristics 1-2
1.7. Environmental 1-3
1.8. Preset Timing Modes 1-3

1.1. Monitor Control Locations & Functions



KEY TO MONITOR CONTROL FUNCTIONS		
(1)	**Factory Setting Recall Function**	Press to reset button for recall the origional factory setting and press and hold for 3 seconds (minimum) to reset all modes to factory setting.
(2)	**Push Button for OSD On/Off and Selection Confirm**	Press to call up OSD functions onto screen and confirm the control button selection for OSD icon.
(3)	**Control Button for Adjusting Setting and OSD Function Selection**	Control button for adjusting the setting, left button for increasing and right button for decreasing and selection the OSD function icon.
(4)	**Brightness Control Button**	Increase/decrease raster black level using control button adjusting, left button for increasing and right button for decreasing.
(5)	**Contrast Control Button**	Increease/decrease video gain using control button adjusting, left button for increasing and right button for decreasing.
(6)	**Power On/Off**	Hard power On/Off button. Adjacent LED is lit when on. The LED color is green for normal condition and changes to orange for DPMS condition.

1.2. Product Overview

The monitor installed in the CPD-200SX (RMH 7T11/2/3) phom described in this service manual has the following features:

- ☐ 17 inches 0.26mm dot pitch conventional CRT
- ☐ 30~70kHz horizontal scanning
- ☐ 50~150kHz vertical refresh rate scanning
- ☐ 28 total memory modes in standard configuration
- ☐ Universal segmented auto range Power Supply
- ☐ VESA/NUTEK/EPA compliant power management

1.3. CRT Characteristics

- ☐ Screen Size..... 17 inches
- ☐ Faceplate Type..... Cylinder
- ☐ Phosphor Dot Pitch..... 0.26mm, stripe pitch
- ☐ Electron Gun..... 29mm,trinitron gun
- ☐ Deflection Angle ..... 90 degree diagonal
- ☐ Shadow Mask..... Aperture grille
- ☐ Phosphor Type..... P22
- ☐ Phosphor Persistence ..... Medium Short
- ☐ Standard Light Transmission 42% Typical

1.4. Power Specifications

1.4.1. Power Supply

- ☐ A/C Receptacle..... IEC320
- ☐ Power Supply Type ..... Universal
- ☐ A/C Line Voltage Ranges .. 88VAC-132VAC
180VAC-264VAC
- ☐ A/C Line Frequency Ranges 50Hz/60Hz±3Hz
- ☐ Inrush Current..... 30A/132V or
50A/264V (at cold start)
- ☐ Leakage Current..... ≤3.5mA
- ☐ Degauss..... Automatic and Manual
(20 minutes for a
full recovery)

1.4.2. Power Management

- ☐ Summary of operating states:

APM State	LED Color	Power Consumption	Automatic Recovery Time
On	Green	< 150W	Not applicable
Standby	Orange	< 30W	<3 seconds
Suspend	Orange	< 8W	<10 seconds
Off	Orange	< 8W	<10 seconds
Self test	Green	< 150W	Not applicable

- ☐ Signaling compliant with VESA DPMS guidelines
- ☐ Nutek 1992 guidelines ..... Suspend < 30 watts,
off < 8 watts
- ☐ EPA Energy Star ..... Standby < 30 watts

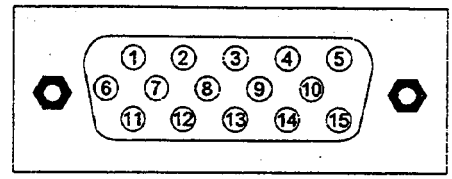
1.5. Video Specifications

1.5.1. Video Amplifier Performance

- ☐ Bandwidth (dot rate) 86MHz
- ☐ Typical 10%~90% rise and fall times.....calculation
9.0ns
- ☐ Video generator rise / fall times.....2ns maximum
- ☐ Scope and probe bandwidth. 350MHz minimum
- ☐ Probe capacitance..... 2.5pf
- ☐ Overshoot / Undershoot.... 10% maximum
- ☐ Sync on green..... Amplitude : 714mV maximum
sync on green amplitude : 286mV maximum

1.5.2. Video Input Signal Characteristics

- ☐ Video Type..... Analog
- ☐ Amplitude ..... 700mV maximum
- ☐ Video Input Impedance .... 75 Ohms±1%
- ☐ Optional DDC 1/2B video Connector Pin Assignments:



pin	Signal	pin	Signal	pin	Signal
1	Red video	6	Red return	11	Monitor GND
2	Green video	7	Green return	12	SDA
3	Blue video	8	Blue return	13	H. sync
4	Monitor GND	9	No pin	14	V.sync(VCLK)
5	No pin	10	Sync return	15	SCL

1.6. Sync Input Signal Characteristics

1.6.1. Separate Sync

- ☐ Sync Type ..... TTL
- ☐ Amplitude ..... 2.4V minimum
(Logic High), 0.8V max.(Logic Low)
- ☐ Polarity..... Positive or Negative
- ☐ Equalization pulses ..... Not allowed

1.6.2. Composite Sync

- ☐ Sync Type ..... TTL
- ☐ Amplitude ..... 2.4V minimum(Logic High)
0.8V max.(Logic Low)
- ☐ Polarity..... Positive or Negative
- ☐ Serration pulses ..... Allowed at horizontal rate

- ☐ Equalization pulses ..... Not allowed

1.6.3. Sync On Green

- ☐ sync Type..... As per Apple
- ☐ Amplitude ..... 0V minimum (Logic High)
  -286mV max.(Logic Low)
- ☐ Polarity ..... Negative/composite
- ☐ Serration pulses..... Allowed at horizontal rate
- ☐ Equalization pulses ..... Not allowed

1.7. Environmental

1.7.1. Temperature/Humidity/Altitude

OPERATING :

- ☐ Temperature..... 10°C to 40°C
- ☐ Relative Humidity ... 0 to 90%,non-condensation
- ☐ Altitude ..... 0 to 10,000 feet

NON-OPERATING :

- ☐ Temperature..... -40°C to +65°C
- ☐ Relative Humidity ... 0 to 95%,non-condensation
- ☐ Altitude ..... 0 to 40,000 feet

1.7.2. Vibration Test

UNPACKED UNIT :

	Frequency	Amplitude	Acceleration(G)
1	5-22Hz	0.25mm	-
2	22-500Hz	-	0.25G

Times/Cycle:

- ☐ Rise Time..... 10 Minutes
- ☐ Fall Time..... 10 Minutes
- ☐ Number of Sweeps ..... 1 Cycle
- ☐ Axis..... X,Y,Z
- ☐ Total Times..... 60 Minutes

PACKAGED UNIT :

	Frequency	Amplitude	Acceleration(G)
1	5-50Hz	-	0.83G
2	-	-	-

Times/Cycle:

- ☐ Rise Time..... 10 Minutes
- ☐ Fall Time..... 10 Minutes
- ☐ Number of Sweeps ..... 1 Cycle
- ☐ Axis..... X,Y,Z
- ☐ Total Times..... 60 Minutes

1.7.3. Drop Test

- ☐ Compliant with NSTA Project 1A guidelines
- ☐ Drop Height..... 46cm
- ☐ Test Direction ..... 1 Corner, 3 Edges, 6 Face

1.8. Preset Timing Modes

This display has 10 preset display modes configured during manufacture, given in the following table:

Mode No.	H. KHz	V. Hz	Dot Time
01	68.680	75.060	1152x870
02	68.677	84.997	1024x768
03	63.980	60.010	1280x1024
04	60.241	74.927	1024x768
05	60.023	75.029	1024x768
06	53.674	85.061	800x600
07	49.725	74.550	832x624
08	46.875	75.000	800x600
09	31.469	59.942	640x480
10	31.469	70.080	720x400

Section 2.
Disassembly Instructions

2.1. Removing the Base and Rear Cover 2-1
2.2. Internal Disassembly (Right Side)..... 2-1
2.3. Internal Disassembly (Left Side)..... 2-1
2.4. Removing the Neck Board and Main Board 2-2

2.1. Removing the Rear Cover

1. Remove the four screws at the rear cover. Refer to the figure 2-1 (A).
2. Remove the rear cover.

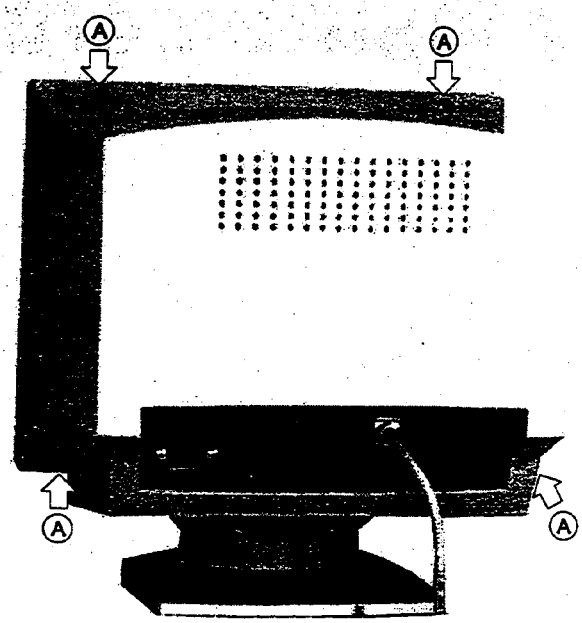


Figure 2-1 Remove the Base

2.2. Internal Disassembly (Right side)

The neck board is plugged on to the CRT neck and is enclosed in a metal shielding.

1. Disconnect the two ground wires from the neck shield. Refer to the figure 2-2 (A).
2. Disconnect the ground wire from the U bracket. Refer to the figure 2-2 (B).
3. Rlease the two cable wires to free the cable. Refer to the figure 2-2 (C).
4. Remove the three connected pins from the main board. Refer to the figure 2-2 (D).
5. Remove the two screws at the bezel. Refer to the figure 2-2 (E).
6. Remove the nylon revet holding from the bezel. Refer to the figure 2-2 (F).

2.3. Internal Disassembly (Left Side)

1. Disconnect the ground wire from the neck shield. Refer to the figure 2-3 (A).
2. Disconnect the ground wire from the U bracket. Refer to the figure 2-3 (B).
3. Remove the two connected pins from the main board. Refer to the figure 2-3 (C).
4. Remove the connected pin from the neck board. Refer to the figure 2-3 (D).

IMPORTANT NOTE

To avoid risk of electric shock, before removing the anode cap, made sure tdhe anode has been completely discharged as high voltage may remain on the anode for extended time after power off.

5. Remove the anode cap from the CRT. Refer to the figure 2-3 (E).
5. Remove the two screws at the bezel. Refer to the figure 2-3 (F).
6. Remove the nylon revet holding from the bezel. Refer to the figure 2-3 (G).

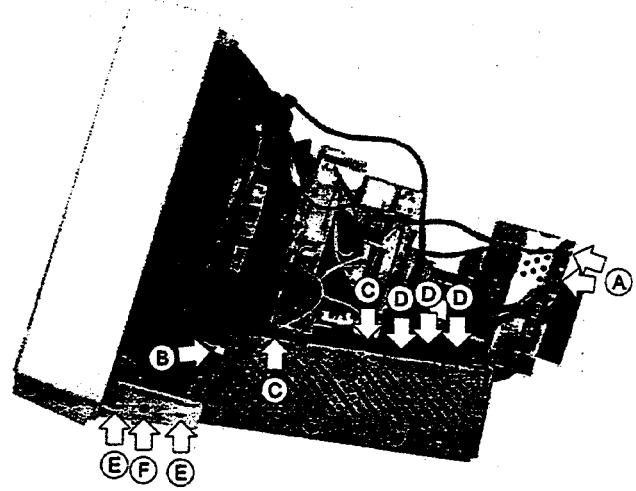


Figure 2-2 Remove the screws

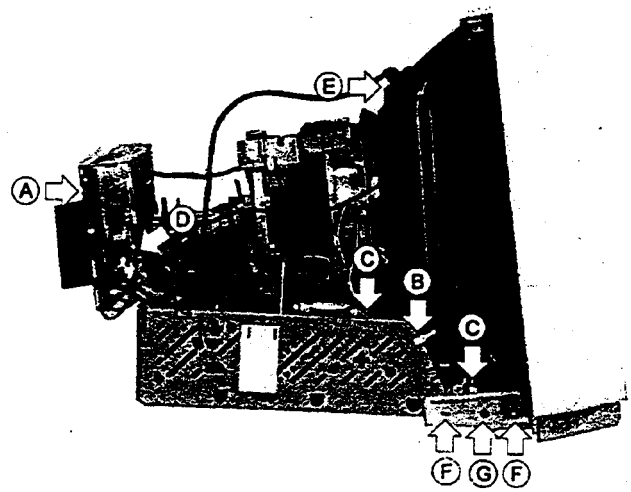


Figure 2-3 Remove the Rear Cover

2.4. Removing the Neck Board & Main Board

1. Rmove the three ground wires from the neck shield. Refer to the figure 2-4 (A).
2. Remove neck shield.
3. Remove Neck Board.
4. Remove the Main Board.

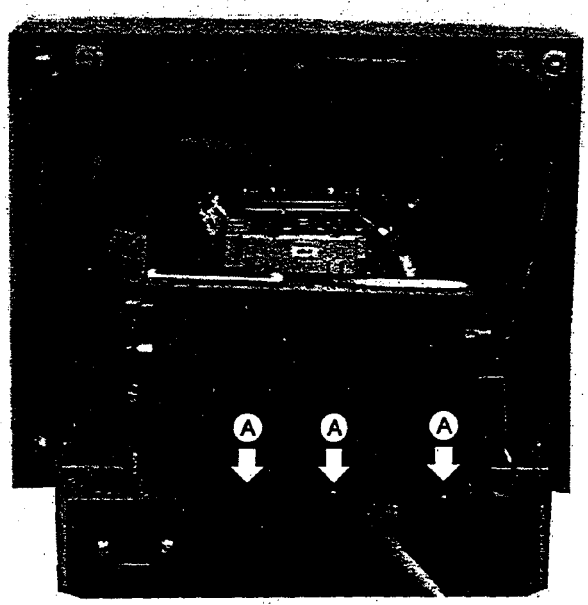


Figure 2-4 Internal Disassembly (Right Side)

Notes

Section 3.
Theory of Operation

3.1. Switching Power Supply 3-1
3.2. The Deflection Circuit 3-2
3.3. Video Amplifier 3-12
3.4. Microprocessor and Sync Processing..... 3-13

3.1. Switching Power Supply

The switching power supply (SPS) used in this display is a 150W flyback mode type. The power supply provides six outputs (177V, 75V, 15V, -12V, 6.3V and +5V). Please refer to schematic diagram for details of the circuit layout. The input voltage is from 88VAC — 264VAC with an input frequency of 47Hz — 63Hz. as shown in figure 3-1.

The current first passes through the EMI control circuit and is regulated to DC by the bridge diode (BD901) and filter capacitor (C907). During rectification a large current surge is generated and as C907 has a very low impedance while being charged the fuse, on/off switch and bridge diode are all liable to be damaged. For this reason, a thermal resistor (NTCR) is added before the bridge diode in order to limit the large current surge generated during the charging of the capacitor.

During rectification, C910 is charged through R903 and R904. When C910 is charged to 16V, IC901 3842A starts to operate (for details, of the functions of this IC, please refer to the relevant data sheet) and outputs a pulse signal from Pin 6 to set the transistor Q902 in the ON state. At this time, transformer T903, which is connected in parallel, starts to store power. When the current passing through the resistor R914, and the supplementary current from R957 and R964 into Pin 3 of IC901 reaches 1.1V, IC901 is reset, causing the energy stored by the transformer to reach the rated value. In order to prevent the transformer from being saturated and causing damage to the transistor, when transistor Q902 is in the OFF state, the energy stored in the transformer T903 is released into the secondary coil and is regulated through the various output loops and filters and converted to the required DC output. In addition to this, at the appropriate time, the windings pin1 — pin2 supply Pin 7 of IC901 with a fixed power supply for normal operation. Also, when windings pin2 — pin3 are in power saving active state, power is supplied to Pin 7 of IC901 for normal operation.

In any of the above cased, the output pulse is terminated and the FET is turned off, causing the voltage on the output of the FET to rise rapidly, and the voltage across the winding of the primary to reverse in polarity, thus tending to reset the flux within the core. At this point, the diodes D915, D925, D917-D920 and D926 on the secondary supply winding become forward biased and begin to conduct, thus transferring energy from primary to the secondary, and charging the secondary capacitors.

There is also secondary winding the primary side of the power supply which, through diode D908 and Q901 recharges the control IC901 reservoir capacitor C910. This supply then keep the IC901 running. In the event of a secondary short circuit, the supply fails to recharge, thus the voltage across C910 drops to a threshold limit below which the IC901 cuts out and returns to its low current load operation.

During normal operation, the supply rails charge until the error amplifier realized by IC903 on the secondary begins to turn on the opto-coupler, PH901. At this point, the photo-transistor of this opto-coupler on the primary side begins to conduct, draining current from the primary control IC901 supply through diode D907 and D928.

Under normal operation IC903 regulates the current flow through PH901, and hence determines the output voltage of the error amplifier internal to IC901. Various passive components around IC903 and IC901 set the gain compensation for optimum stability and regulation characteristics.

In the event of a fault condition occurring, either Q904 may be turned on by the lack of voltage at pin2 of IC901 or zener diode ZD903 may conduct, due to excessive voltage on the primary IC901 supply. In the latter case, the triac Q903 will fire, thus dragging down the output of the control IC901 error amplifier, which in turn will limit the duty cycle and reduce the output voltage. It will stay in this mode until the AC input power is removed.

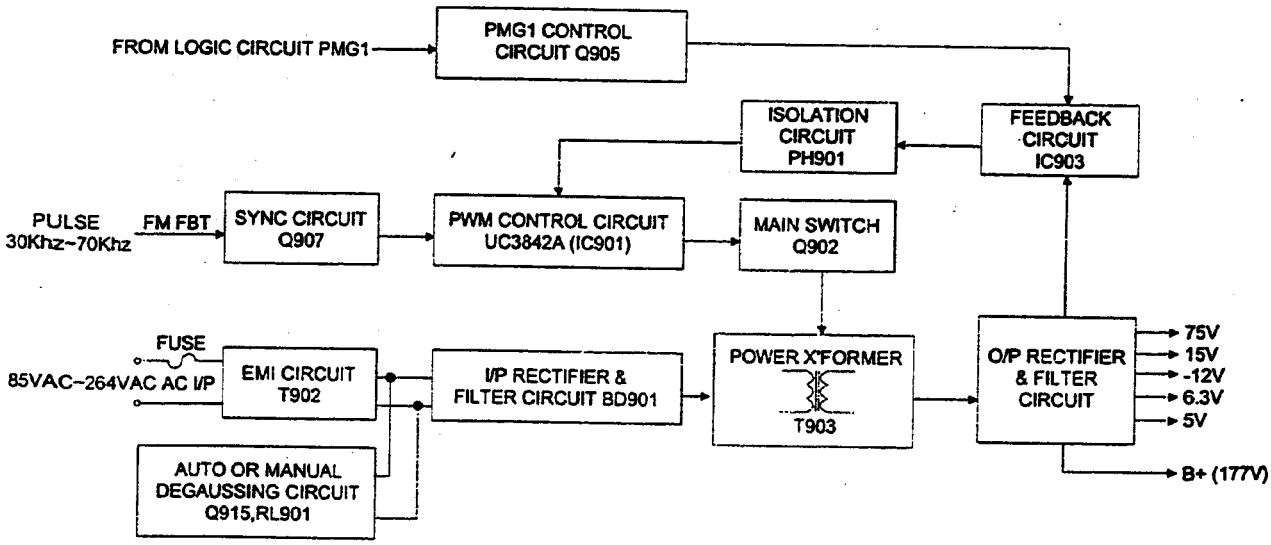


Figure 3-1 Switching Power Supply Block Diagram

When the feedback signal passing through the main 75V output is completed, the transistor's duty cycle is adjusted through the transfer to Pin 2 of IC901 3842A of the primary coil by PH901 4N35 and IC903 TL431, stabilizing the output current. At this time, it is important to note that before the feedback signal is established, the charge level of C917 cannot trigger Q903 SCR or it will cause a faulty power startup. In addition, in order to synchronize the supply power and monitor and reduce noise that will cause interference to the display, in the area D913 the monitor's feedback transformer gets a feedback signal in order to ensure synchronization between the power supply and monitor, with synchronization in the range 30kHz — 70kHz. Because the power operating frequency changes with the monitor causing changes in the value of IP, (the value of LP is fixed while the value of IP increase or decreases according to the frequency), this affects the test value of Pin 3 of IC901 3842A. This causes the total power supplied to vary according to the frequency, so a compensation value is provided by D914 in order to reduce the difference in total power for different frequencies. In addition, because the AC input ranges from 85VAC to 264VAC, this causes the value of the direct current on the DC bus to vary, affecting the rise rate of IP, the oscillator and the duty cycle, and causing the test value obtained at Pin 3 of IC901 to vary. To resolve this, a compensation value is provided by R964 and R957 which reduces the difference resulting from the different input voltages.

3.1.1. Auto-degaussing

When base of Q915 connector is in high state, the transistor Q915 2SC945P is on, causing the relay to jump from Normal Open (N.O.) to Normal Close (N. C.) to perform auto-degaussing operations. The duration of this operation is controlled by a logic pulse and lasts approximately 6 (six) seconds. When transistor Q915 enters the OFF state and the relay returns to N.O. to terminate the auto-degaussing operation is completed.

3.1.2. Suspend Mode Operation

Two feedback ratios can be selected, both sensing from the 75V rail. In the event of Q905 being turned on by micro processor, additional current is drawn from the virtual earth node of IC903, thus causing the power supply to serve the rail to a high voltage, nominally 75V. This is trimmed by resistor R937, R940 and R941. The other supply rail are predetermined ratios of this winging, being +15V, -12V, 6.3V and 177V nominally. In addition, a low voltage primary side winding feeds the control IC901 directly through D907 turning off the control IC901 supply through Q901, which would otherwise dissipate excessively.

When Q905 is turned off, the 75V rail drop to around 17V. In this case, the primary control supply fed through D907 drops to a value that is below the level needed to sustain operation. Instead, Q901 begins to conduct and the higher voltage supply winding taken via D908 is used to keep the primary side powered up with minimal power losses.

The 5V power supply is driven by one of two sources. In normal operation when the 75V is present, the 5V regulator, IC902 is fed from the 15V rail through diode D921. When switched to standby mode (75V rail drops to 12V) then the 15V rail drops too low to supply IC902. In this case Q906 take over and maintains the supply to IC902 at around 9V.

In addition to the 5V regulated supply, in normal operation there is also a 15V regulated supply take from the 15V rail.

To ensure that micro processor gets a good 5V power supply, there is a power good detection circuit formed by Q801 and Q802. This monitors the supply going into the 5V rail (not the 5V rail directly). It detects whether there is sufficient voltage to enable the 5V regulator to work effectively. It is not a detection of the 5V rail itself, but relies upon the premise that the regulator is not faulty and that there is no faulty load condition on the 5V.

During power up, there is a delay to the signal at the output of the threshold comparator Q801 and Q802 a caused by ZD801 and C801, in order to allow the micro circuit time to stabilize. The threshold is chosen such that the RESET line drops low at least 25ms before the 5V drop out of regulation.

Finally a synchronization pulse taken from the horizontal output stage maintains the SMPS operating frequency in sync with the horizontal scan. D913 injects a pulse which prematurely triggers the oscillator within IC901 which would otherwise run at a frequency lower than the minimum required sync frequency.

3.2. The Deflection Circuit

Please refer to the block diagram of the deflection circuit and video circuit and Logic circuit as shown in figure 3-2.

3.2.1. IC301 LM1291 Video PLL System for Continuous-Sync

The LM1291 is an integrated horizontal time base solution specifically designed to operate in continuous-sync video monitors. It automatically synchronizes to any H ferquency from 30kHz to 85kHz and provides the drive pulse to the high power deflection circuit.

Available sync processing includes a vertical sync separator and a composite video sync stripper. An internal sync selection scheme gives highest priority to separate H and V sync, then composite sync, and finally sync on video, no external switching between sync sources is necessary is necessary. The LM1291 provides polarity-normalized H/HV and V sync outputs, along with logic flags which show the respective input polarities.

The design uses an on-chip FVC (Frequency to Voltage Converter) to set the center frequency of the VCO

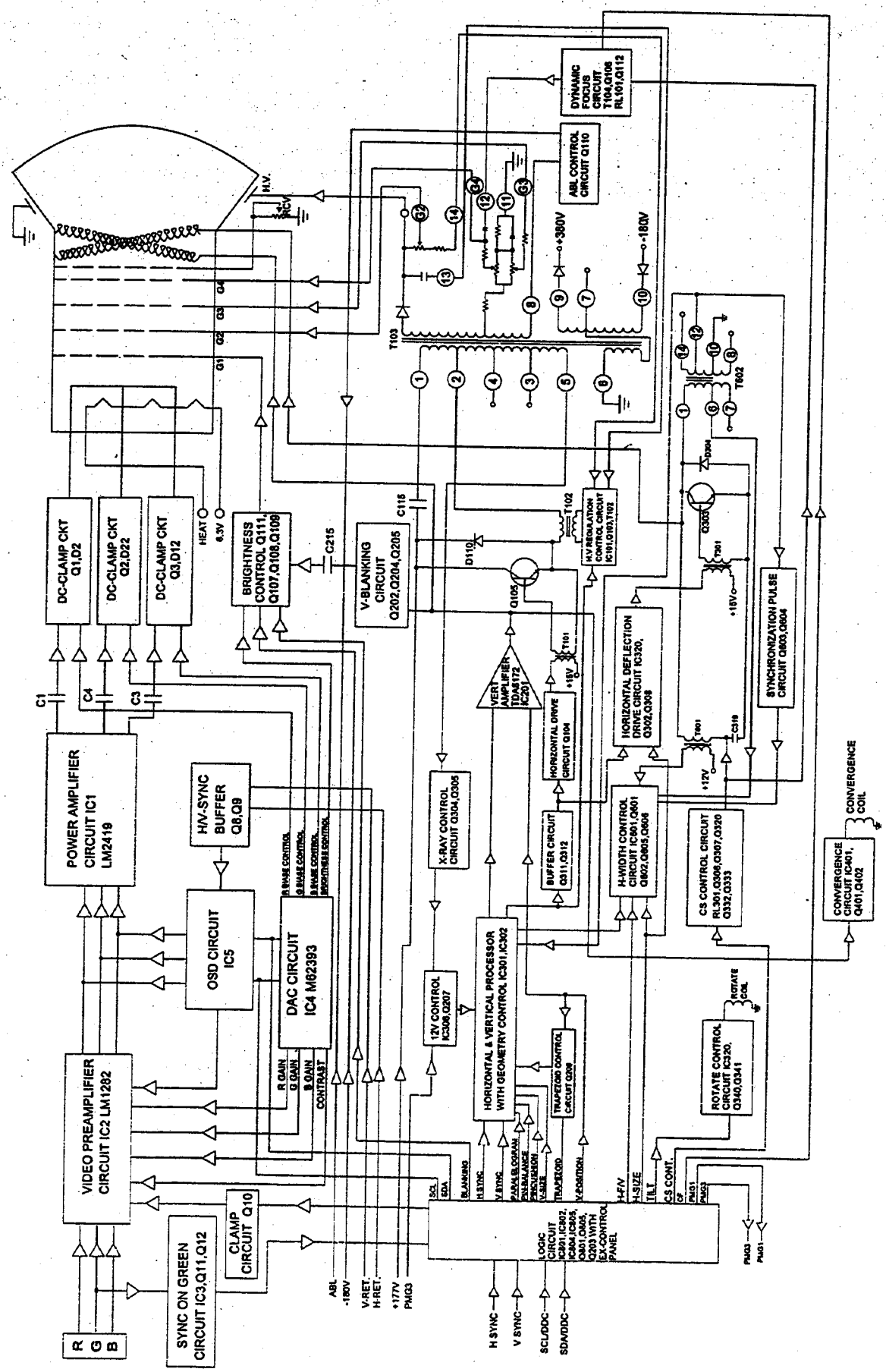


Figure 3-2 Video,Logic,Audio and Deflection Block Diagram

(Voltage Controlled Oscillator). This technique allows autosync operation over the entire frequency range using just one optimized set of external components.

The system includes a second phase detector which compensates for storage time variation in the horizontal output transistor, the picture's horizontal position is thus independent of temperature and component variance.

The LM1291 provides DC control pins for H drive duty cycle and flyback phase.

3.2.2. IC301 LM1291 Pin Descriptions

Pin 1 Clamp Control:
This low impedance current mode. When there is no H sync in sync-tip mode, the clamp pulse is generated by the VCO at the frequence preset by pin 5. This feature is intended for use in on screen display system.

Pin 2 Clamp pulse:
Active -low clamp pulse output.

Pin 3 Video Mute:
This open-collector output produces an active-low pulse when triggered by a step change of H sync frequency.

Pin 4 F-Max:

A resistor from this pin to ground sets the upper frequency limit of the VCO.

Pin 5 F-Min:
A resistor from this pin to ground sets the lower frequency limit of the VCO.

Pin 6 Voltage Refer CAP:
This is the decoupling pin for the internal 8.2V reference.

Pin 7 VCC:
12V nominal power supply pin.

Pin 8 Vertical Sync In:
This pin accepts AC-coupled vertical sync of either polarity.

Pin 9 Composite Video In:
The composite video sync stripper is active only when no signal is present at pin 12 (H/HV In). The signal to pin 9 must have negative going sync tips which are at least 0.14V below black level.

Pin 10 H/HV CAP:
A capacitor is connected from this pin to ground for detecting the polarity and existence of H/HV sync at pin 12.

Pin 11 H/HV Sync Out:
The sync processor outputs active-low H/HV sync derived from the active sync input (pin 9 or pin 12). Pin 11 stays low in the absence of sync input.

Pin 12 H/HV Sync In:
This pin accepts AC-coupled H or composite sync of either polarity.

Pin 13 H/HV Pol Out:
A low logic level indicates active-high H/HV sync to pin 12, a high level indicates active-low. Pin 13 stays low in the absence of H/HV sync.

Pin 14 H Drive Duty Control:
A DC voltage applied to this pin sets the duty cycle of the horizontal drive output (pin 20) . With a range of approximately 30%~70%. 2V sets the duty cycle to 50%.

Pin 15 H Drive EN:
A low logic level input enables H-Drive out (pin 20).

Pin 16 X-ray Shut Down:
This pin is for monitoring CRT anode voltage. If the input voltage exceeds an internal threshold. H-Drive out (pin 20) is latched high and video mute (pin 3) is latched low. Vcc has to be reduced to below approximately 2 V to clear the latched condition, i.e power must be turned off.

Pin 17 Vertical Sync Out:
The sync processor outputs active-low vertical sync derived from the active sync input (pin 8, pin 9 or pin 12). Pin 7 stays low in the absence of sync input.

Pin 18 Flyback In:
Input pin for phase detecor 2. For best operation, the flyback peak should be at least 5 V but not greater than Vcc. A pulse width greater than 1.5μs is acceptable.

Pin 19 Vertical POL Out:
A low logic level indicates active-high vertical sync to pin 8, a high level indicates active-low. Pin 19 stays low in the absence of vertical sync.

Pin 20 Horizontal Drive Out:
This is an open-collector output which provides the drive pulse for the high power deflection circuit. The pulse duty cycle is controlled by pin 14.

Pin 21 Ground:
System ground. For best jitter performance, all LM1291 filter components and bypass capacitors should be connected to this pin via short paths.

Pin 22 Phase Detector 2 CAP:
The low-pass filter cap for the output of phase detector 2 is connected form this pin 21 (GND) via a short path.

Pin 23 Horizontal Drive Phase:
A AC control voltage applied to this pin sets the phase of the flyback pulse with respect to the leading edge of horizontal sync.

Pin 24 Vertical CAP:
A capacitor is connected from this pin to ground for detecting the polarity and existence of vertical sync at pin 8.

Pin 25 FVC CAP 2:
Secondary FVC filter pin. Cfvc 2 is connected from this pin to ground. The width of the video mute (pin 3) pulse is controlled by the time constant difference between the filter at pins 25 and 26.

Pin 26 FVC CAP 1:
Primary FVC filter pin. Cfvc 1 is connected from this

pin to pin 21 (GND) via a short path. The voltage at this pin is buffered to pin 27 (FVC out).

Pin 27 FVC Out:
Buffered output of the frequency-to-voltage converter, which sets the VCO center frequency through an external resistor to pin 28. Care should be taken when further loading this pin, since during the vertical interval it presents a high output impedance. Excessive loading can cause top-of-screen phase recovery problems.

Pin 28 PD 1 Out/VCO In:
Phase detector 1 has a gated charge pump output which requires an external low-pass filter. For best jitter performance, the filter should be ground to pin 21 (GND) via a short path. If a voltage soucrce is applied to this pin, the phase detector is disabled and the VCO can be contorlled directly.

3.2.3. IC302 LM1295 DC Controlled Geometry Correction System

The LM1295 is specifically designed for use in a continuous sync monitor. The injection-locked vertical oscillator operates from 50 Hz to 170 Hz, covering all known video monitors. A differential ouptut current is provided in order to prevent ground interaction.

The IC302 provides two outputs composed of the summation of DC controlled 1st and 2nd order ouptut terms. The first ouptut corrects for EW pincushion and trapezoid. The second corrects for parallelogram and bow.

A DC controlled output is provided for vertical dynamic focus correction.

3.2.4. IC302 LM1295 Pin Descriptions

Pin 1 Ground:
This pin should be connected to the power ground at pin 17.

Pin 2 Vertical Height:
A Voltage between 0V and 4V on this pin controls the amplitude of the +V and -V drive currents, with increasing voltage giving increasing current. The control range is approximately 1.8 to 1. The response time is low, being limited by the automatic level control loop.

Pin 3 4V CAP:
A C202 capacitor aluminum electrolytic or tantalum, should be connected between pin 3 and GND to bypass the internal 4V reference.

Pin 4 Vertical Sync In:
The vertical sync input takes a negative-going TTL level pulse which injection locks the vertical oscillator to the vertical sync frequency if it is above the LM1295 minimum frequency. The minimum pulse width is approximately 200μs. For free-running detection (no vertical sync in), this input should be at logic high.

Pin 5 8V CAP:
A C203 capacitor, aluminum electrolytic or tantalum, should be connected between pin 5 and GND (pin 17) to bypass the internal 8V reference.

Pin 6 Vertical Dynamic Heigh:
A voltage between 3V and 4V on this pin controls the amplitude of the +V and -V drive currents with increasing voltage giving increasing current. The control range is approximately 1.3 to 1.

Pin 7 Vcc:
Vcc should be bypassed to GND (pin 17) with a C216 aluminum electrolytic or tantalum capacitor. The supply voltage is 12V.

Pin 8 Voltage Reference CAP:
A C217 capacitor aluminum electrolytic or tantalum, should be connected between pin 8 and GND (pin 17).

Pin 9 Horizontal Dynamic width:
This output consists of the sum of the vertical ramp and the parabola derived from the ramp. The amplitude and polarity of the ramp signal is DC controlled by horizontal trapezoid control (pin 11) and of the parabola by E-W pin control (pin 10). The weighting of lthe ramp is 1/3 the parabola; i.e, with the horizontal trapezoid and E-W pincushion controls at 4V, the output is 3 parts parabola and 1 part ramp. Horizontal dynamic width is used to correct for trapezoid and east-west pincushion distortion.

Pin 10 E-W Pincushion Control:
A voltage of 0V to 4V adjusts the polarity and the amount of parabola in the horizontal dynamic width (pin 9) output. At approximately 2V, the amount is zero. From 2V to 4V, the amplitude increases and the parabola is positive-going. From 2V to 0V, the amplitude increases and the parabola is negative-going.

Pin 11 Horizontal Trapezoid Control:
A voltage of 0V to 4V adjusts the polarity and the amount of vertical ramp in the horizontal dynamic width (pin 9) output. At approximately 2V, the amount is zero. From 2V to 4V, the amplitude increases and the ramp is positive-going. From 2V to 0V, the amplitude increases and the ramp is negative-going.

Pin 12 Horizontal parallelogram control:
A voltage of 0V to 4V adjusts the polarity and the amount of vertical ramp in the horizontal dynamic center (pin 14) output. At approximately 2V, the amount is zero. From 2V to 4V, the amplitude increases and the ramp is positive-going. From 2V to 0V, the amplitude increases and the ramp is negative-going.

Pin 13 Horizontal Bow Control:
A voltage of 0V to 4V adjusts the polarity and the amount of parabola in the horizontal dynamic center (pin 14) output. At approximately 2V, the amount is zero. From 2V to 4V, the amplitude increases and the parabola is positive-going. From 2V to 0V, the amplitude increases and the parabola is negative-going.

Pin 14 Horizontal Dynamic Center:
This output consists of the sum of the vertical ramp and the parabola derived from the ramp. The amplitude and polarity of the ramp signal is DC controlled by horizontal parallelogram control (pin 12) and of the parabola by horizontal bow control (pin 13). The difference between

this output and the horizontal dynamic width output is in the weighting of the ramp, which is equal to the parabola; i.e with the horizontal parallelogram and horizontal bow controls at 4V, the output is 1 part parabola and 1 part ramp. Horizontal dynamic center is used to correct for parallelogram and bow distortion.

Pin 15 Vertical Dynamic Focus Control:
A voltage of 0V to 4V adjusts the polarity and the amount of parabola in the vertical dynamic focus (pin 16) output. At approximately 2V, the amount is zero. From 2V to 4V , the amplitude increases and the parabola is positive-going. From 2V to 0V, the amplitue increases and the parabola is negative-going..

Pin 16 Vertical Dynamic Focus:
This output consists of the parabola derived from the vertical ramp. The amplitude and polarity are controlled by vertical dynamic focus control.

Pin 17 Ground:
This is the power supply ground for the 12V supply and the point to which the bypass capacitors are returned.

Pin 18 Automatic Level Control CAP:
This capacitor (C204) is part of the level control circuit that maintains constant vertical height in spite of vertical sync frequency changes. If the VCO capacitor value is changed, the capacitor value should change in the same ratio. A R204 resistor should be connected from this pin to ground.

Pin 19 Double Frequency Capacitor:
This capacitor (C218) prevents the vertical oscillator from locking at twice the vertical sync frequrncy. If the VCO capacitor volue is changed, this capacitor value should change in the same ratio.

Pin 20 Oscillator Capacitor:
This is the vertical oscillator capacitor (C232). The value can be changed to change the minimum frequency.

Pin 21 Vertical Resistor:
One end of the vertical resistor connects to this pin. This resistor determines the gain of the vertical ramp current generator. The gain is inversely proportional to the resistance.

Pin 22 Vertical Resistor:
The other end of the vertical resistor connects to this pin.

Pin 23 Vertical Drive:
This is the negative-going vertical ramp output current of the differential pair. The ramp current waveform is superimposed on a direct current of approximately 315μA. The waveform amplitude is determined by the vertical height (pin 2) control voltage and the vertical dynamic (pin 6) control voltage. The current can be converted into voltage by a R236 resistor to ground or by a differential amplifier using the differential currents as inputs. The voltage compliance of the output is typically 6V.

Pin 24 + Vertical Drive:
This is the same as vertical drive except it is the positive-going output current of the differential pair.

3.2.5. Vertical Deflection Circuit

1. IC201 TDA8172 consists of a flyback generator, voltage stabilizer, drive circuit and vertical output amplifier.

2. **The vertical oscillator circuit**

   (a) The frequency and phase of the vertical oscillator circuit is generated by the vertical synchronization signal.

   (b) The synchronization signal is input from Pin 4 of IC302 LM1295, and after being processed by the synchronization circuit, is sent to the vertical synchronization oscillator circuit to trigger the vertical oscillator and synchronize the oscillator frequency with the external synchronization signal. The frequency of its internal free oscillation is set by the time constant of C232. It does not need an external F/V control because this IC302 can keep vertical synchronization. Pin 18 provides vertical A.L.C function. So the pin 18 of IC302 is use to maintain the difference between the free oscillation frequency and external synchonization signal frequency at a similar level and make the sawtooth wave amplitude from pin 24 of IC302 the same.

3. **Vertical Size Control**

   The pulse voltage output by the oscillator is sent to the sawtooth wave generator. The size and amplitude of the voltage of the sawtooth wave generation can be changed by DC value which output from Pin 35 of IC801 (PWM) and the vertical size can thus be controlled. This sawtooth wave voltage passes through a buffer and is output from Pin 24 of IC302 to pin 1 of IC201 TDA8172 of the vertical drive circuit.

   The vertical ramp and DC offset are also controlled by PWM output. The vertical ramp generated across C232 is buffered internally to IC302 by DC controlled variable gain stage. The voltage level is derived from pin 35 of IC801 (PWM) through the R210, R206 and C206 of grneration, then into pin 2 of IC302.

4. **Vertical Drive Circuit**

   (a) It is not sufficient to rely solely on the oscillator circuit output to ensure the stability of the vertical output, so a first or second level amplifier circuit must be inserted between the oscillator circuit and the output. This circuit is called the drive amplifier and in addition to amplifying the sawtooth wave also corrects the vertical linearity.

After adding the drive circuit, because the level of amplification can be considerable, enough negative feedback can be added to correct vertical linearity and increase the stability of the circuit.

(b) If the current of the sawtooth wave flowing through the deflection yoke is distorted, then the top and bottom portions of the display will be expanded or compressed, resulting in poor linearity. In order to solve this problem, correction of the linearity of the sawtooth wave can be carried out before the drive level.

5. **IC201 TDA8172 Vertical Drive Circuit**

The IC201 uses a double power source, so it can be viewed as an OCL drive amplification circuit.

In order that the DC coupled output stage accurate DC reference, a DC reference voltage is taken from pin 5 of IC302. This used as the reference voltage (via divider resistors, R214 and R216) for the DC coupled power amplifier IC201. This is a simple voltage to current inverting amplifier, using R223 to derive a voltage proportional to the current in the deflection winding of the yoke. This voltage is fed back to the virtual signal earth inverting input of the power amplifier(pin1) by R219. This back to back diode feedback network modifies the linearity of the transfer characteristic in order to give precept "S" correction linearity, in addition to the variable correction in the ramp generator.

The vertical output amplifier has a voltage boost circuit to triple the positive supply voltage during retrace in order to speed up flyback. It does this by charging capacitor C210 through diode D202 during the normal forward scan. Pin6 of the IC201 is the voltage supply to the power output stage. When flyback occurs, pin3 is switched to the positive supply rail on pin2, thus adding the voltage across C210 to that of the supply rail, effective doubling the supply momentarily.

6. **Vertical Centering Adjustment**

Since IC201 functions as an OCL circuit, VDC is output from Pin 7 of IC201, so the central current can be changed to shift the on-screen display up or down to prevent voltage fluctuation. After adjusting the power stabilizer at Pin 5 of IC302 LM1295 (about 8V) and R214, R216 this is input to Pin 7 of IC201 to change the value of the vertical center.

The DC operating point of the amplifier can be varied by the pin 38 of IC801 (vertical position) output and via R212, C207 and R213 to pin 7 of IC201 which adds or subtracts an offset into the output, thus varying the DC offset of the scan and hence the vertical centering.

3.2.6. Geometry Correction Circuit

1. If the width of the border in the center of the screen is insufficient, the waveform shown in Figure 3-3 below, can be used to add to horizontal deflection B+ in order to change the deflection of the horizontal deflection circuit. This waveform is the parabola obtained after regulation of the vertical period, and is created to perform amplitude modulation on the horizontal deflection current, as shown in Figure 3-4.

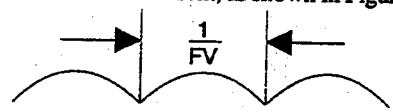
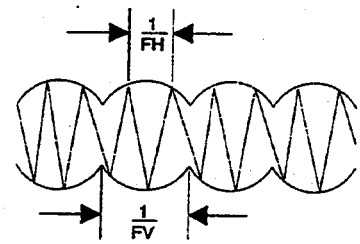


Figure 3-3 Voltage Correction Wave



FH: Horizontal Frequency
FV: Vertical Frequency

Figure 3-4 Current Correction Wave

2. The sawtooth wave is output from Pin 9 of IC302 and through C350 and R364 and input to Pin 2 of IC601 (DC to DC circuit). It is then output from Pin 6 of IC601 and after being sent to T603's second coil output, is added to horizontal B+ to provide pincushion and trapezoid distortion correction. So, is created to preform amplitude modulation on the horizontal deflection output pluse, as shown in figure 3-5.

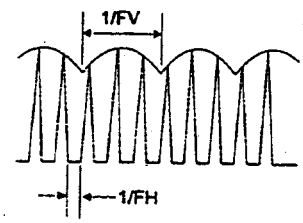


Figure 3-5 Collector of Q303 Output Pluse Correction Wave

3. The sawtooth wave is output from pin 14 of IC302 and through R353 and C314 and input to pin 23 of IC301. It is added to horizontal phase to provide parallelogram and bow distortion correction.

3.2.7. Structure of Horizontal Deflection Circuit

The function of the horizontal deflection circuit is to cause left/right scanning of the electron beam using

the sawtooth wave current flowing through the horizontal deflection yoke, and is made up of the horizontal oscillator circuit, horizontal drive circuit, horizontal output circuit, synchronous AFC circuit and high voltage generator circuit.

1. **Horizontal Drive Amplifier**
In order to rapidly saturate the output transistor (ON) or cut it off (OFF), a sufficient basic current must be provided. Because of this, an amplifier circuit is added between the oscillator circuit and the output circuit to amplify the pulse voltage. At the same time, after the waveform has been regulated, by adding this circuit to the output circuit, this amplification circuit functions as a drive amplifier.

IC301 LM1291 consists of a vertical sync selection polarity circuit, composite video sync stripper circuit, AFC circuit, H/V sync and cómposite sync circuit, voltage control oscillator circuit, phase regulator circuit, X-Ray circuit, video mute circuit, voltage regulator circuit and horizontal drive duty cycle circuit. This IC includes the vertical and horizontal circuits combined in one package.

When the synchronization signal input to logic circuit and pin 12 of IC301. The pin 20 of IC301 output horizontal frequency is achieved by the pin 1 of IC801 and flyback pulse from pin 12 of T602 (A.F.C) fed to pin 18 of IC301. So, the pin 20 of IC301 output horizontal frequency through Q311, Q312, Q302, Q104 T101 and T301 provide a horizontal output transistor base current of Q303 and horizontal anode voltage generator output transistor base current of Q105.

The horizontal output transistor base drive is taken from a conventional base drive transformer stage. This circuit as in a similar manner to a flyback power supply. The square wave horizontal oscillator output signal is coupled into the base of emitter drive stage transistor Q302, Q104, T301, T101 across the +15V supplies. This causes the primary current to increase linearly until such time as Q302 and Q104 turns off, hence storing a predetermined amount of flux energy in the transformer. As Q302 or Q104 turns off, and the primary current falls to zero, the secondary voltage is driven above the threshold of the base-emitter junction voltage of the horizontal output transistor Q303 or Q105. Current flows through R320, R321, L301, L302 and D303 into the base of Q303 or through R116, R150, L101 and D130 into the base of Q105 hence turning this device on. The high base current of around 1.1A. Lamps is so high that Q303 or Q105 is driven heavily into saturation. This is important in order that the collector voltage should be as low as low as possible whilst conducting the high peak currents that flow through the horizontal deflection winding. In turn, this is vital to limit dissipation.

At the required time as determined by the horizontal oscillator, the base drive transistor is turned back on. The voltage at Q302 or Q104 collector fall rapidly back towards the ground rail. However, the secondary current still remains flowing in a positive direction for a short time, due to the finite leakage inductance of T301 or T101. Also, due to the heavy saturation of Q303 or Q105, the base voltage remains at around 1V. The current in the secondary winding rapidly reverses and goes sharply negative as the charge stored within the base region of Q303 or Q105 is removed. D303 or D130 helps to speed up this charge removal. Note that during this time, the collector output of the Q303 or Q105 is still turned on, even though the base current is flowing out of the base.

This period of time is known as the storage time of the device and may take between 2-3us, depending upon peak collector current and temperature and various other design factors. Finally, when all charge in the base region of Q303 or Q105 is dissipated the base current suddenly stops, and the secondary current drops almost instantly to zero. At that point, the device now become non conducting and the collector current flow also terminates. The secondary voltage on T301 or T101 drops to it's unloaded voltage and the current flow in the primary settles to it initial value once more.

2. **Horizontal Equivalent Output Circuit**
The horizontal output circuit uses the switch operation of a transistor and a damping diode, and provides a sawtooth wave current to the deflection yoke. The horizontal deflection yoke is made up of the L value on the coil and resistance r inside the coil connected in series. Its resistance is extremely small, and the time constant (L/r) is extremely large. Because of this the voltage at the two terminals of the coil cause rapid variation in the current flowing in the coil still will slowly vary, creating a sawtooth current. The basic circuit and equivalent circuit are shown in Figures 3-6 and 3-7.

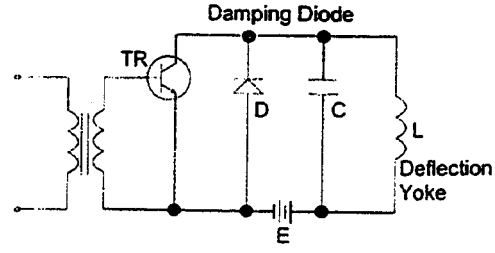


Figure 3-6 The Basic Deflection Circuit

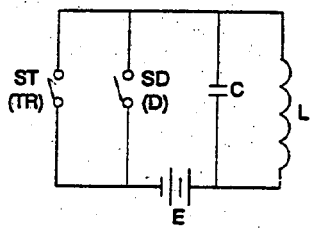


Figure 3-7 Equivalent Circuit

3. **Horizontal Output Equivalent Circuit Operation**

Refer to Figure 3-8 for the current wave of the voltage of the horizontal output circuit during operation.

(a) t1 — t2 Period

The base of the output transistor is added to the forward bias voltage. As the current through the base is very large, it will cause the output transistor to be saturated, corresponding to the ON state of S1 in the equivalent circuit. At this time the deflection yoke contains a current flow and because the time constant is large, the current will slowly show a linear increase as shown in Figures 3-8 (b) and 3-9 (a).

(b) t2-t3 Period

At t2, a negative load is applied to the to the base and the output transistor changes to OFF (S1 in open state). There is no current passing through the transistor at this time and the L and C components of the deflection yoke become independent oscillation circuits. If the current is suddenly cut off, then the polarity of the inverse voltage generated at L will be as shown in Figure 3-9 (b). This voltage is viewed as the source voltage and will cause current to flow, at which time the current flowing to C is as shown in Figure 3-8 (d). At time t3 this current is 0 but the voltage at the two capacitor terminals is at maximum. This waveform is known as flyback pulse, and is shown in Figure 3-8 (f).

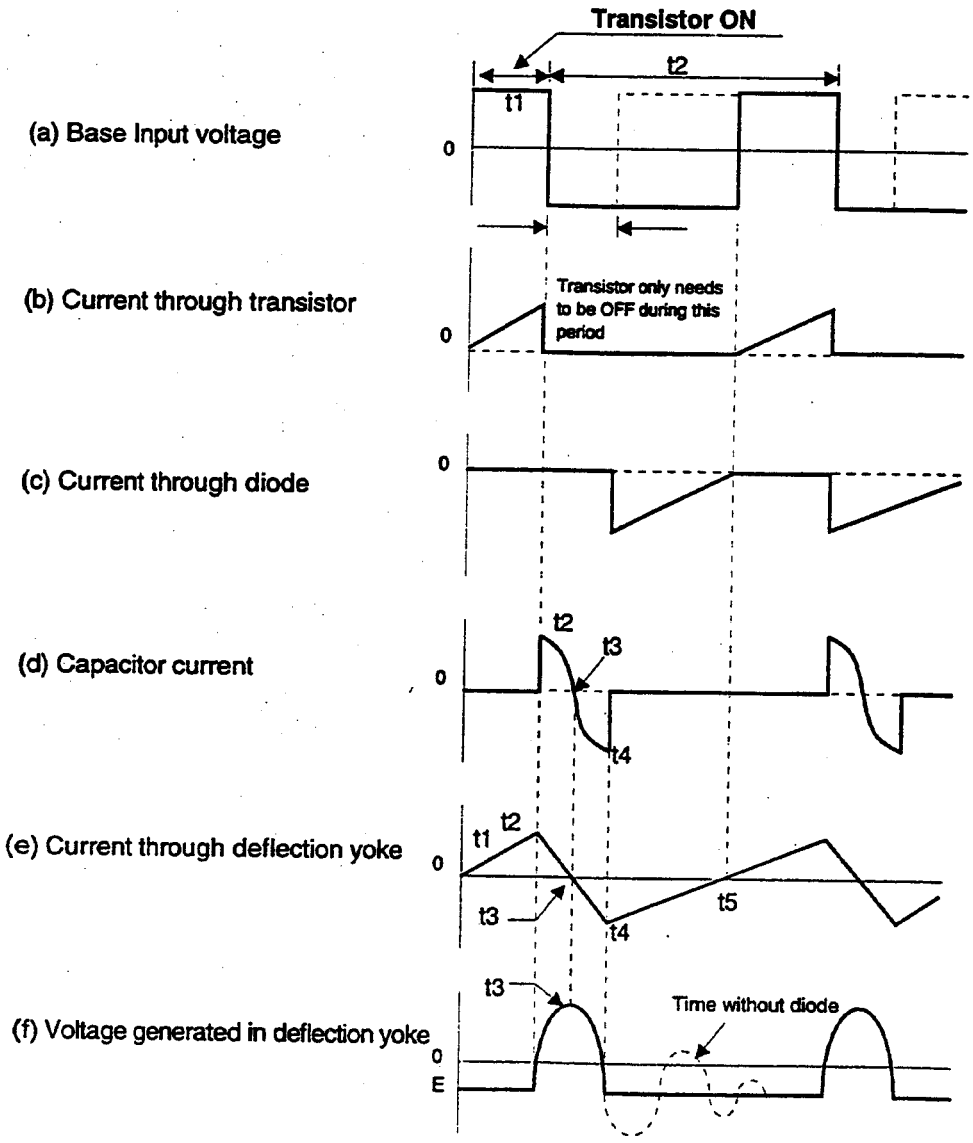
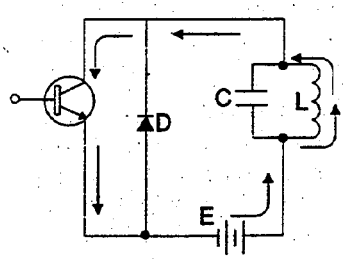
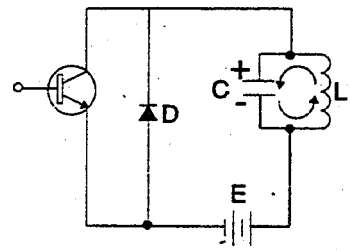


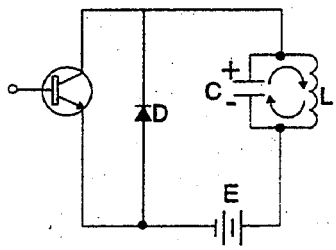
Figure 3-8 Horizontal Output Voltage/Current Waves



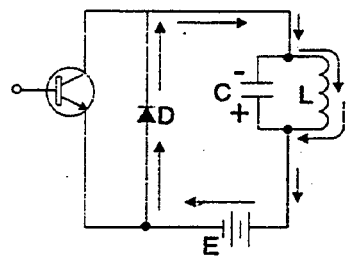
(a) Second half of scanning period (t1 - t2)



(b) First half of return line period (t2 - t3)



(c) Second half of return line period (t3 - t4),



(d) First half of scanning period (t4 - t5)

Figure 3-9 Polarity of Transformer Voltage

(c) (t3 — t4) Period

The energy accumulated in C is released to the deflection yoke, the direction of the current flow being shown in Figure 3-9 (c). The current increases as the voltage on C decreases, and at time t4, the voltage of C is 0, at which time the current is at maximum, which means the current flowing into the deflection yoke is also maximum. C is then charged and if a damping resistor is not connected, the energy between L and C will be reversed, which is the oscillation frequency set by the oscillator at L and C.

(d) t4 — t5 Period

At t4, the voltage of C is 0. After this it is recharged in the opposite direction and this voltage exceeds the voltage of the power source at time t4. At this time the damping diode is ON and the L and C circuits are shorted out and stop oscillating. Because of this the time constant of r and L in the damping diode is large so the current flowing in the deflection yoke does not suddenly become 0. The current shows a linear decrease, and when it becomes 0 at time t5 the transistor is ON and the operation described above is repeated.

As described above, the current flowing in the deflection yoke during scanning is the sum of the current which has passed through the transistor and the damping diode current. Please refer to Figure 3-8 (e).

4. **Horizontal output operation:**

The actual output stage differs from the simple model described in a number of ways. Refer to the basic schematic of the major components in Figure 3-10 on the following page.

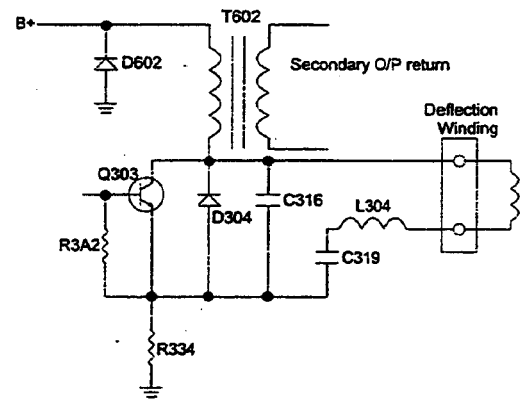


Figure 3-10 Basic Horizontal Deflection Output Circuit

The main inductance L is now divided into the primary winding of the Flyback Transformer (FBT) T602 and the deflection yoke winding. The deflection yoke is coupled through a capacitor C319, which has two function. Primarily it prevents DC unwanted DC currents flowing through the deflection yoke which would otherwise cause an undesirable deflection of the CRT beam.

Secondly, the voltage drop across it due to the AC ramp current flowing causes a parabolic modulation in the slope of the ramp, leading to a progressive curve in the ramp, symmetrical about the zero current value as shown in Figure 3-11. This intentional distortion of the linear ramp is required to compensate for the 'S', or symmetric linearity distortion in the CRT.

In series with C319 and the deflection yoke is another indicter, L304. This is a saturating indictor that is biased with a permanent magnet.

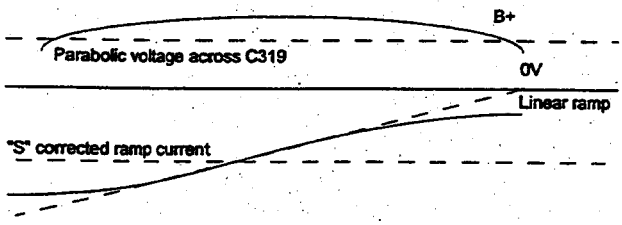


Figure 3-11 Linear Ramp Distortion

Consequently this device has a linearity that is higher for current flow in one direction than in the opposite direction. This function provides compensation for resistive losses that would otherwise cause an undesirable exponential curve to the linear ramp, resulting in asymmetrical linearity errors in the displayed image.

The voltage seen in the output stage require special attention. The B+ supply can varying between 60-180V. The main flyback pulse seen across Q303 and associated components is around 1100Vp. Consequently, appropriate precautionary measures must be taken when servicing the monitor.

In addition to the basic topology as described above, there are a number of other additional devices. Q306, Q307 and Q333 can be independently turned on or off under logic control. These devices switch addition capacitors, C320, C322 and C367 in parallel with C319 to alter the amount of 'S' correction at different horizontal scan frequencies.

D308 and D309 acts as a constant current source that can be under SW301 and SW302 control. This current source drives an adjustable constant current into L304. This current flows into the deflection yoke and adds a variable DC offset to allow image raster centering to be achieved.

The B+ provides current for the deflection coil (D/Y). Therefore, changes in deflection current can be controlled by modifying B+ voltage. As a result, horizontal width can be modified. In order to obtain the side horizontal width for different frequencies, a DC to DC feedback circuit is added. The synchronization signal comes from deflection output, from pin 12 of T602 to base of Q603 which drives Q604 to trigger pin 4 of IC601. Feedback signal come from secondary on T601, via D604, R611 and R612 to become a DC voltage on pin 2 of IC601, another feedback signal passes through emitter of Q303, via R606 on pin 3 of IC601. There signals determine duty cycle of output signal of IC601 which is coupled to T603 to drive Q601, to control B+, making it possible to have correct deflection current and horizontal width on different frequencies. Similarly, output pin 36 of IC801 drive through R368, C348 and R610 to control duty cycle of IC601 output to achieve horizontal width adjustment.

During mode change, the B+ supply can be instantly turned off by pulling up the error amplifier input on pin 1 of IC601. These can be achieved by Q602, Q606 and Q605 which is driven from the logic circuit pin 9 of IC801 (MUTE). Whilst Q602, Q606 and Q605 can switch off the B+ supply almost instantly, the time taken for the supply to restart is programmed by the value of logic circuit.

In addition, the B+ (177V) supply is configured so as to maintain a constant anode voltage. The anode voltage is derived from the flyback transformer T103. As the flyback voltage across the primary is already a high voltage pulse of around 800Vp, it requires only a modest turns ratio to step this pulse up to around 27kV, the working voltage of the CRT. Refer to the basic schematic of the major components in figure 3-12.

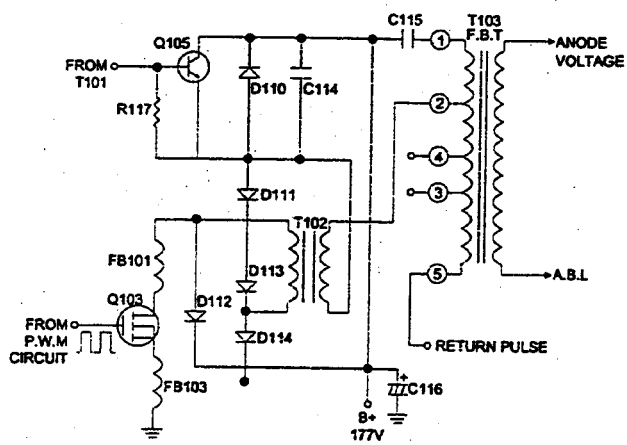


Figure 3-12 Basic High Voltage Output Circuit

The flyback pulse at the primary of T103 is proportional to the both frequency and the supply rail B+. In order to maintain the anode voltage at a constant 27kV a regulation system is required. This is achieved using a PMW regulation stage formed by a IC101 driving a Q103. The causes a regulating current on primary T102, the voltage changes in secondary T102 result in a constant high voltage, synchronized by the horizontal oscillator. The IC101 has an error amplifier that generates an error signal from the feedback network formed by the high voltage bleed resistor and capactior (it is internal to T103). Resistors VR101, R103 and R104 set the DC feedback ratio, and by adjustment of VR101, this ratio can be adjusted at setup to set the high voltage at it's nominal value of 27kV. The AC frequency response of the serve loop is set by C104 and R114 for

optimum stability and relegation characteristics.

The output of the error amplifier which can be observed on pin 1 of IC101 is internally compared with a DC voltage. This DC is produced across.

The average beam current through the CRT also flows through the secondary high voltage winding of T103 connected to pin 8 of T103, C132 and R138 smooths the pulse of current flowing in the secondary winding and the average DC current is supplies through resistor R137 and VR106. When the average secondary current flowing exceed 460mA, this voltage begins to drop below this threshold. Thus a signal is generated which can be fed to video amplifier for automatic beam current limiting (ABL).

3.2.8. X-RAY Protection Circuit

The feedback pulse voltage from T103 F.B.T is regulated through D302 to obtain a DC voltage and the appropriate set voltage is distributed by R323 and R324. When the feedback pulse voltage exceeds the set voltage, a DC voltage develops in the cathode of ZD302 which turns on Q304 and Q305. As a result, the pin 1 of IC306 (adj-pin) to 0V, so IC306 is turned off, putting the 12V is not output. This is the phenomenon of high voltage protection.

3.2.9. The Focus Circuit

The output waveform come from pin 16 of IC302 through C122 and R123 to the amplifier Q106, via T104 with horizontal waveform to modulation. After, the wave coupling of the T103 which make the focus performance on the C.R.T. This is waveform shown in figure 3-13.

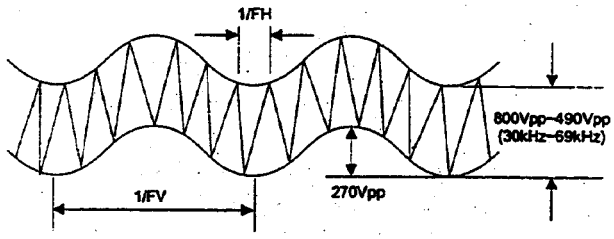


Figure 3-13 Focus Correction Wave

3.2.10. Horizontal linearity and CS Switching

Switching CS is necessary to ensure the lines are in accordance with the specifications in multi-sync monitors.

- For frequencies 58~69kHz, Q307 and Q333 are OFF and RL301 is ON, so CS is only C319, but L304 and L305 in parallel.
- For frequencies 45~58kHz, Q307 is OFF, RL301 and Q333 are ON, so CS are C319 and C367 in parallel, but L304 and L305 are in parallel.
- For frequencies 39~45kHz, RL301, Q307 and Q333 are OFF, so CS are C319 and C320 in parallel, but linear coil is only L304.
- For frequencies 33~39kHz, RL301 and Q307 are OFF, Q333 is ON, so CS are C319, C320 and C367 in parallel, but linear coil is only L304.
- For frequencies 29~33kHz, RL301is OFF, Q307 and Q333 are ON, so CS are C319, C320 C322 and C367 in parallel, but linear coil is only L304.

Truth Table of Frequency Discriminator

FEQ CS	29~33 kHz	33~39 kHz	39~45 kHz	45~58 kHz	58~69 kHz
CS1	L	L	L	H	H
CS2	L	L	H	L	H
CS3	L	H	H	H	H
CF	L	L	L	L	H

Truth Table of Power Saving Detector

Mode	H-sync	V-sync	PMG1	PMG3	Mute	Blanking
ON	Pulse	Pulse	1	0	0	0
Standby	No Pulse	Pulse	1	1	1	1
Suspend	Pulse	No Pulse	0	1	1	1
OFF	No Pulse	No Pulse	0	1	1	1

3.2.11. The Misconvergence Circuit

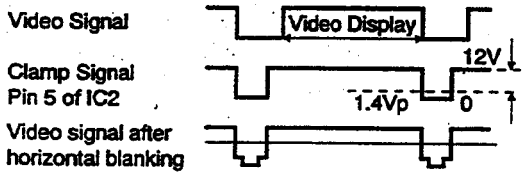
The sawtooth wave come from IC201 through R401 and C401 to the pin 2 and pin 6 of IC401 amplifier. The sawtooth wave is output from pin 7, pin 14 and pin 8 of IC401 which amplify of two group amplifier defines, by VR401, VR402 and VR403 for adjustment. Then, the top, bottom and center portions of the display will be expanded or compressed, resulting in poor convergence on the horizontal lines. In order to solve this problem, correction of the horizontal line convergence of the sawtooth wave can be carried out before the drive balanced. Via Q401 and Q402 a manner push pull current amplifier which provide to achieve horizontal linc convergence correction.

3.3. Video Amplifier

The RGB video and sync signals are supplied through a video cable directly to the Video Board at connector P1. The RGB signals are terminated in 75 ohms by R39 and R42, R38 and R41.

The RGB signals then enter an IC2 LM1282 video pre-amplifier, providing synchronous black level clamping, variable picture contrast (gain) and RGB gain balance for alignment. Separate gain control voltages for the three pre-amplifier channels are provided via R34, R33 and R32 from the IC4 M62393 DAC which is loaded by the microcontroller via the I2C bus. These inputs enable the individual gains of each channel to be varied to allow channel gain balance. In addition, a common signal is applied on pin13 of IC2 to adjust all three channels by the same amount, to allow for overall gain or contrast control.

A synchronous clamping signal is derived from the horizontal sync pulse by Q10. This takes the trailing edge of the horizontal sync pulse, differentiates it through C39 and R53, which is applied pin 15 of IC2. The timing is shown in Figure 3-14.



NOTE:

A. Clamp signal is generated from horizontal sync pulse time.

B. When the Clamp signal is less than 1.4Vp-p, the IC's internal clamp loop will operate; when greater than 1.4Vp-p, it will not operate.

Figure 3-14 Timing of Pin 15 Clamp Signal

The outputs of the video pre-amplifier are fed to IC1, a hybrid power amplifier IC type LM2419, through resistors R21, R23 and R25. In addition, on screen display video information generated by IC2 can be injected via R28, R29 and R27 through pin 1, pin 2, and pin 3 of IC2.

IC1 amplifies the video signals to around 40Vp-p. The outputs are AC coupled to the CRT cathodes via C1, C4 and C3. In order to bias the DC level of the cathodes correctly, the AC coupled signal is DC restored by clamping to a DC voltage which can be varied under microprocessor control. Considering Red channel output on IC1 as an example, the signal is clamped by D2 to the voltage set by the transistor amplifiers formed by Q1, which amplify the adjustable voltage at the output of the DAC. A similar stage can be seen for the green and blue channel outputs.

When the RC video signal amplification circuit is added for amplification, this waveform will change as shown in Figure 3-15 (a). Without the DC component, as shown in Figure 3-15 (b), the DC level of darker and brighter displays will be different, so when this kind of signal without a DC component is sent to the CRT, it will cause the contrast of the image to change as the signal changes. Therefore Q1, Q2, Q3, D2, D22 and D12 serve as a DC clamp and the CRT's cathodes DC voltage can be adjusted by the pin 13, pin 14, pin 15 of IC4 M62393 DAC.

IC5 is an On Screen Display processor. This is a simple video generation IC5 that has its own oscillator circuit. The oscillator circuit by using an internal Phase Locked Loop (PLL) the IC5 can sync to the incoming vertical and horizontal oscillator frequencies and produce the OSD video signals once initialized and loaded by the commands and data received on the I2C bus. When the OSD display is activated, the blanking

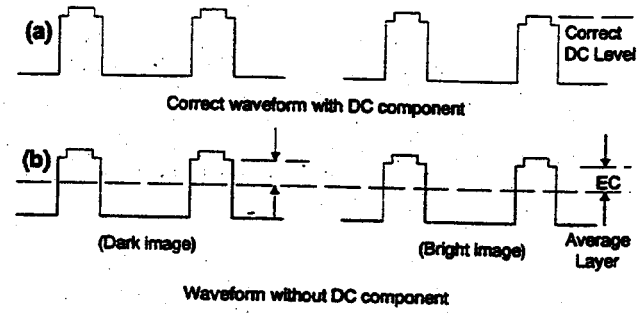


Figure 3-15 The Post Output Amplifier Circuit

output of the IC5 also sends a signal to the blanking input of IC2 (pin 4) to provide an optional black background for the OSD display.

The RGB signals are amplified to drive the CRT by an IC1 LM2419 hybrid amplifier and capacitively coupled to the cathodes.

Brightness control is achieved by varying the bias of G1 of the CRT via a transistor stage formed by Q111 which is also driven by an output of the pin 12 of IC4. Vertical blanking signals is coupled into this amplifier Q204, Q205 and Q202 to prevent visible retrace lines.

3.4. Microprocessor And Sync Processing

The microprocessor is a MC68HC705BD3P type. It is particularly suitable as multisync computer monitor controller. This 8-bit microcontroller unit (MCU) contains an onchip oscillator, CPU, RAM, ROM, M-Bus serial interface system (IIC), parallel I/O, Pulse Width Modulator, Multi-Function Timer and sync Signal Processor. It has a 7.75k bytes of ROM and 256 bytes of RAM on internal which contains a basic communication 'boot' routine and various other simple routines. It is also used to store the OSD icon bit map. The main firmware routines and variable data stored in the 16k external EEROM, IC802.

When the micro is instructed via the IC2 bus, the internal ROM boot routine will load up the EEROM with program data from the IC2 bus. Thus it can be made to load its own firmware. From then on it will run jointly out of EEROM and internal ROM. Another important routine within the internal ROM is the routine which allows data writes to be made to the EEROM. This must be resident in the micro as it cannot run from the EEROM whilst writing data. These control the addressing and I/O port selection from the micro CPU in the IC801 (MC68HC705BD3P).

Also specialized ports Pin16, Pin 17 and Pin18 of IC801 form the M-Bus interface which is used internally to set the DAC valuse and the OSD IC and CS table control IC (IC801). Other way, specialized ports pin 11 and pin 12 of IC801 from the M-bus interface which is used internally to set the data to external EEROM IC802. In addition, the I/O ports from pin

19 to pin 23 of IC801 from the M-bus interface which is used internally to set the front panel control.

There are 16 PWM channel. Channel 0 to channel 7 are dedicated PWM channels while channel 8 to channel 15 are shared with ports C under the control of the corresponding configuration register. Thus it can be made to control H-PHASE, PARALLELOGRM, PIN-BALANCE, TRAPEZOID, PINCUSHION, TILT, V-SIZE, H-SIZE and V-POSITION on the pin 1, pin 26, pin 27, pin 28, pin 29, pin 34, pin 35, pin 36, pin 37 and pin 38 of IC801.

The micro also drives the sync selection circuits. IC801 is used to set the polarity of the incoming sync signals and allows the micro to sample the vertical and horizontal syncs and to select the correct polarity on the outputs H-SYNC and V-SYNC appropriately. In addition, whilst sampling the polarity, the micro can measure the frequency of both syncs. By suitable selection of H-SYNC and V-SYNC control lines, it does this when ever a mode change occurs. A mode change is detected by either a change in vertical frequency, which is monitored by firmware, or by a sudden change in horizontal frequency.

When power is disturbed to the unit, the power reset line goes low. This also causes an input to the micro via the MODEC line. On detecting this interrupt, the micro first checks inputs Pin 4 of IC801. If these are also low, then it knows the MODEC interrupt was caused by an impending power failure. In this case the micro saves the current RAM data in EEROM and prepares for power off. The RESET line is delayed for 7ms by R801, ZD801, R803 and C801 to allow time for the data to be saved. The REST line then holds off the micro and the EEROM until power is good once more.

Notes

Section 4.
Setup Adjustments

4.1. Preparing the Display for Adjustment 4-1
4.2. Adjustment Procedures 4-1
4.3. High Voltage Verification 4-2
4.4. X-ray Protection Check 4-2
4.5. G1 Voltage Adjustment 4-2
4.6. Background Brightness Setting 4-2
4.7. Screen Brightness Adjustment 4-2
4.8. Magnetic Field Configuration 4-3
4.9. Raster Center Verification 4-3
4.10. Tilt Verification 4-3
4.11. Focus Verification 4-3
4.12. Color Misconvergence 4-3
4.13. Primary Test Mode Performance Adjustment 4-3
4.14. Performance Adjustments for All Preset Mode 4-3
4.15. Image Performance Verifications 4-4
4.16. Uniformity Verification 4-4
4.17. Brightness Verification 4-4
4.18. Display Size Stability 4-4
4.19. Color Purity Verification 4-4
4.20. Video Noise 4-4
4.21. Power Saving Check 4-4
4.22. DDC 1/2 Data Wirting 4-4

4.1. Preparing the Display for Adjustment

Before adjusting any the display settings or making final adjustments after service, perform the following pre-test settings to prepare the display for adjustment:

1. Be sure to allow the display to warm up for at least 30 minutes before making any adjustments.
2. When making tests and adjustments, the CRT should be facing east or west to minimize the affect of the earth's magnetic field.
3. Set the contrast control at 80% and the brightness control at 50% for all tests unless otherwise specified.
4. Thoroughly degauss the entire screen with a manual degausser before proceeding with tests.
5. All test should be performed with the rated power supply voltage unless otherwise specified.

4.1.1. Test Equipment Required

The following equipment will be required to make the tests and adjustments detailed in this section:

- ☐ Video signal and pattern generator
- ☐ Digital multimeter
- ☐ Degausser

4.2. Adjustment Procedures

4.2.1. Adjustment Sequence

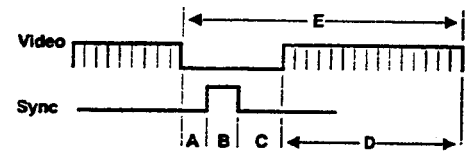
This display undergoes an automatic alignement procedure during manufacture. This alignment procedure follows a fixed sequence of adjustments which are dupplicated in this section. When making manual adjustments during service, you should always make the adjustments in the order given here to ensure correct results.

4.2.2. Preset Timings Used During Adjustment

During alignment it is necessary to input certian preset timings stored in the display. The detailed parameters of all the preset timings are given in the table below for your reference.

IMPORTANT NOTE

The preset timings for different versions of this model may differ from those shown here. Be sure to check the list of preset timings for the unit being serviced.



Mode Number	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8	Mode 9	Mode 10
Data Pixel	1152	1024	1280	1024	1024	800	832	800	640	720
Data Line	870	768	1024	768	768	600	624	600	480	400
H. Freq.(kHz)	68.680	68.677	63.980	60.241	60.023	53.674	49.725	46.875	31.469	31.469
V. Freq(Hz)	75.060	84.997	60.010	74.927	75.029	85.061	74.550	75.000	59.942	70.080
Pixel Rate(MHz)	100.000	94.500	110.550	80.000	78.750	56.250	57.280	49.500	25.175	28.322
Hor. FP µs(A)	0.320	0.508	0.434	0.400	0.203	0.569	0.559	0.323	0.636	0.636
Hor. Sync µs(B)	1.280	1.016	1.737	1.200	1.219	1.138	1.117	1.616	3.813	3.813
Hor. BP µs(C)	1.440	2.201	1.882	2.200	2.235	2.702	3.910	3.232	1.907	1.907
Hor. Active µs(D)	11.520	10.836	11.578	12.800	13.003	14.222	14.524	16.162	25.422	25.422
Hor. Total µs(E)	14.560	14.561	15.631	16.600	16.660	18.631	20.111	21.333	31.778	31.778
Ver. FP ms(A)	0.044	0.015	0.032	0.050	0.017	0.019	0.020	0.021	0.318	0.381
Ver. Sync ms(B)	0.044	0.044	0.063	0.050	0.050	0.056	0.060	0.064	0.064	0.064
Ver. BP ms(C)	0.568	0.524	0.563	0.498	0.466	0.503	0.784	0.448	1.048	1.112
Ver. Active ms(D)	12.667	11.183	16.006	12.749	12.795	11.179	12.549	12.800	15.253	12.711
Ver. Total ms(E)	13.322	11.765	16.663	13.347	13.328	11.756	13.413	13.333	16.683	14.269
Polarity(H.V)	-,-	+,+	+,+	-,-	+,+	+,+	-,-	+,+	-,-	-,+
Primary mode is 60.023kHz / 75.029Hz (1024x768)										

Table 4-1 Table of preset Timing Parameters

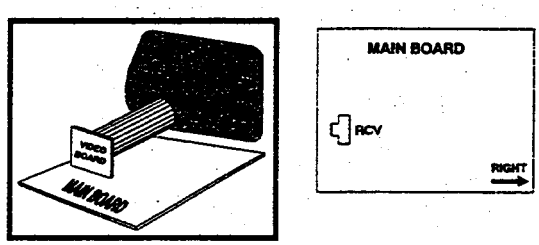
IMPORTANT NOTE

The adjustment settings in this section are based on REVISION C of the factory alignment procedures. Appendices detailing changes in the factory alignment procedures that have occurred since publication of this service manual are available upon request.

Initial settings to be carried out manually prior to automatic alignment:

4.3. High Voltage Verification

1. Input a cross hatch pattern in 68.68KhZ (1152X870) mode and adjust VR101 on the main board (see figure 4-1 for approximate location) so the high voltage is in the range 27kV±0.1.
2. Input a full white pattern in 31.47kHz (640x480) mode, check that the high voltage is in the range 27kV±0.2.



Location of PCBs

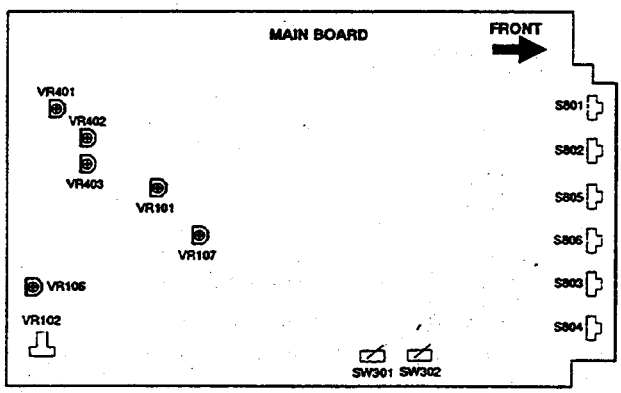


Figure 4-1 Location of on Mainboard & Neckboard

4.4. X-ray Protection Check

Input a cross hatch pattern in 68.68kHz (1152x870) mode, and use the 430kΩ resistor in parallel R103, then the X-ray protection circuit shall be operation.

4.5. G1 Voltage Adjustment

Input a raster pattern (video OFF) in primary mode and push the external brightness control button to maximum. Adjust VR102 (see Figure 4-1 for approximate location) so that the voltage of G1 read on a digital multimeter is -12V±1.

Steps used in white balance adjustment:

4.6. Background Brightness Setting

1. Input a raster pattern in primary mode and push the external brightness control button to maximum. Adjust the SCREEN VR so background brightness is approximately 0.8FL±0.1.
2. Before carrying out white balance adjustment, make sure that the dispiay size and linearity are in spec.
3. Before carrying out white balance adjustment, make sure that the VR106 (see Figure 4-1 for approximate location) position shall be turn counterclockwise to the end (ABL no action).
4. Before carrying out white balance adjustment, make sure that the internal contrast VR107 (see Figure 4-1 for approximate location) shall be turn to the center position.
5. Input timing in primary mode, and the white balance automatic adjust some item as blow.
   a) Input no video pattern in primary mode, and set-up brightness of raster white balance get the x,y value is x=0.283±0.01 y=0.298±0.01.
   b) Input a full white pattern in primary mode, and set-up 9300 degrees kelvin of picture white balance get the x,y value is x=0.283±0.01 y=0.298±0.01.

4.7. Screen Brightness Adjustment

1. Input a raster pattern video off in primary mode. Set external brightness key to maximum and external contrast key to minimum, then make sure that the raster brightness range is 0.7FL±0.2. If not in this range, adjust screen VR of F.B.T.
2. Input a raster pattern in primary mode. Set external contrast key to maximum and push external brightness key to brightness is 0.007FL (cut OFF), then switch to a display of full white pattern and adjust internal contrast VR107 and check that brightness at the center of the screen is in the range 32FL±1.
3. Input a full white pattern in primary mode. Set external brightness and contrast key to maximum. Adjust VR106 and check that brightness at the center of the screen is in the range 40FL±1.

Conclusion White Balance Adjustment:

4.8. Magnetic Field Configuration

Configure the magnetic field as follows:

- Northern hemisphere : H=0.01, V=0.45
- Southern hemisphere : H=0.01, V=-0.52

4.9. Raster Center Verification

Input a cross hatch pattern in 68.68kHz (1125x870) mode, and check raster H-Center shall be less than 3mm ($|L-R| \leq 3mm$). If not in this ranged and select SW301 for adjustment raster H-center shall be less than 3mm, if not in this ranged again, please select SW302 for adjustment raster H-center in the specification.

4.10. Tilt Verification

Input a cross hatch pattern in primary mode and use the tilt rotation key to ensure that tilt is less than 1mm.

4.11. Focus Verification

1. Input a full white pattern in primary mode. Use the external brightness control to adjust background brightness so it is not visible and set external contrast so the brightness is 30FL, then switch to a display of cross hatch pattern.
2. Adjust the FBT focus VR1 and VR2 so the vertical line and horizontal line are as clear as possible.
3. Input a "o" characters pattern in primary mode and check "o" characters is clearest.

4.12. Color Misconvergence

1. Input a full white pattern in primary mode and adjust external brightness so there is no background brightness and external contrast so the screen brightness is 30FL.
2. Switch to a cross hatch pattern and verify that misconvergence in a circle measured from the center of the screen (Area A) is not greater than 0.3mm, and for all areas outside Area A is not greater than 0.4mm.
3. If not in the specification, as following as below items.
   a) Input a cross hatch pattern in primary mode. Adjust RCV (see Figure 4-1 for approximate location) get the color convergence of vertical line is in the most excellent way.
   b) Input a cross hatch pattern in primary mode. Adjust VR403 (see Figure 4-1 for approximate location) get the color convergence of center horizontal line is in the most excellent way.
   c) Input a cross hatch pattern in primary mode. Adjust VR402 and VR401 (see Figure 4-1 for approximate location) get the color convergence of top and bottom horizontal line is in the most excellent way.
   d) After used the magnetic in a four corner adjustments for arrive to better color convergence.

Automatic camera alignment procedure:

The procedures listed below are those carried out using the automatic Camera Alignment System (CAS). These adjustments cannot be made manually but must be performed using the CAS software provided by the manufacturer.

4.13. Primary Test Mode Performance Adjustments

1. **V. RASTER CENTERING**
   Raster area centered vertically in the bezel.
2. **ROTATION (TILT)**
   Raster area aligned with bezel.

4.14. Performance Adjustments for All Preset Modes

1. **H POSITION**
   Centers the picture display horizontally in the bezel area ($|L-R| \leq 1mm$).
2. **H SIZE**
   Configures picture display width as 300±3mm.
3. **V POSITION**
   Centers the picture display vertically in the bezel area ($|T-B| \leq 1mm$).
4. **V SIZE**
   Configures picture display height as 225±3mm.
5. **V Linearity**
   Configures vertical linearity as less than 8%.
6. **Rotation**
   Configures picture display rotation as less than 1mm.
7. **Pin-Balance**
   Sets left and right pin-balance distortion to less than 1.5mm.
8. **PINCUSHION**
   Sets left and right pincushion distortion to less than 1.5mm.
9. **Trapezium**
   Sets upper and lower trapezium distortion to less than 1.5mm.
10. **Parallelogram**
    Sets parallelogram distortion to less than 1.5mm.

Conclusion of automatic alignment:

4.15. Image Performance Verification

Input each of the preset timings and check that the following specifications are met:

1. **Horizontal Position**
   |L-R|≤3mm
2. **Horizontal Size**
   300±3mm
3. **Vertical Position**
   |T-B|≤3mm
4. **Vertical Size**
   225±3mm
5. **Horizontal Linearity**
   H≤10% (10 x 8 cross hatch pattern)
   This calculation is based on the following formula:

$$\frac{Max - Min}{Max} \times 100\% \leq 10\%$$

6. **Vertical Linearity**
   V≤8.0% (10x8 cross hatch pattern).

$$\frac{Max - Min}{Max} \times 100\% \leq 8\%$$

7. **Geometric Edge Distortion**
   All geometrics distortion shall be less than as below:
   Horizontal line ≤2.5mm
   Vertical line ≤2mm
8. **Recall Button Function**
   Adjust H/V phase and size at random using the external controls and press the recall button. Check that the image performance has returned to be in spec, which will indicate the recall button is functioning correctly.

4.16. Uniformity Verification

Input a 2" square pattern in primary mode, set contrast to maximum and check that there is no overshoot. Check that the brightness in the four corners of the screen is not less than 70% of that in the center of the screen.

4.17. Brightness Verification

1. Input a raster pattern (no video pattern) in primary mode. Adjust external brightness to 0.007FL (cut OFF).
2. Input a full white pattern and adjust external contrast to maximum then check that brightness at the center of the screen shall be more than 30FL. Adjust external contrast to minimum and check that brightness at the center of the screen is between 1.5FL~4.5FL.
3. Input a 2" square pattern in primary mode, and adjust external contrast to maximum then check that brightness at the center of the screen is between 30FL~38FL.

4.18. Display Size Stability

Inputer a full white pattern in primary mode, set external brightness at 5FL and measure the display size. Adjust the brightness to 30FL and remeasure the display size. The difference should be less than 0.8mm.

4.19. Color Purity Verification

1. Input a full white pattern in primary mode and adjust external brightness so there is no background brightness and adjust external contrast to 25FL. Make a visual check of color purity as follows:
   a) Input the red (R) signal only; no green (G) or blue (B) should be visible.
   b) Input the (G) signal only; no (R) or B should be visible.
   c) Input the (B) signal only; no (R) or (G) should be visible.

4.20. Video Noise

Input a cross hatch pattern or full white pattern in primary mode and make a visual check from a distance of 48.3cm (19 inches) for any video noise or other on-screen interference.

4.21. Power Saving Check

1. Input cross hatch pattern in primary mode.
2. Turn OFF H-Sync signal, the power indicator LED have to change the emitting color from green to orange, then turn ON H-Sync signal again, the picture shall be visible.
3. Turn OFF V-Sync signal, the power indicator LED have to change the emitting color from green to orange, then turn ON V-Sync signal again, the picture shall be visible.
4. Turn OFF H/V-Sync signal, the power indicator LED have to change the emitting color from green to orange, then turn ON H/V-Sync signal again, the picture shall be visible.

4.22. DDC 1/2 Data Writing

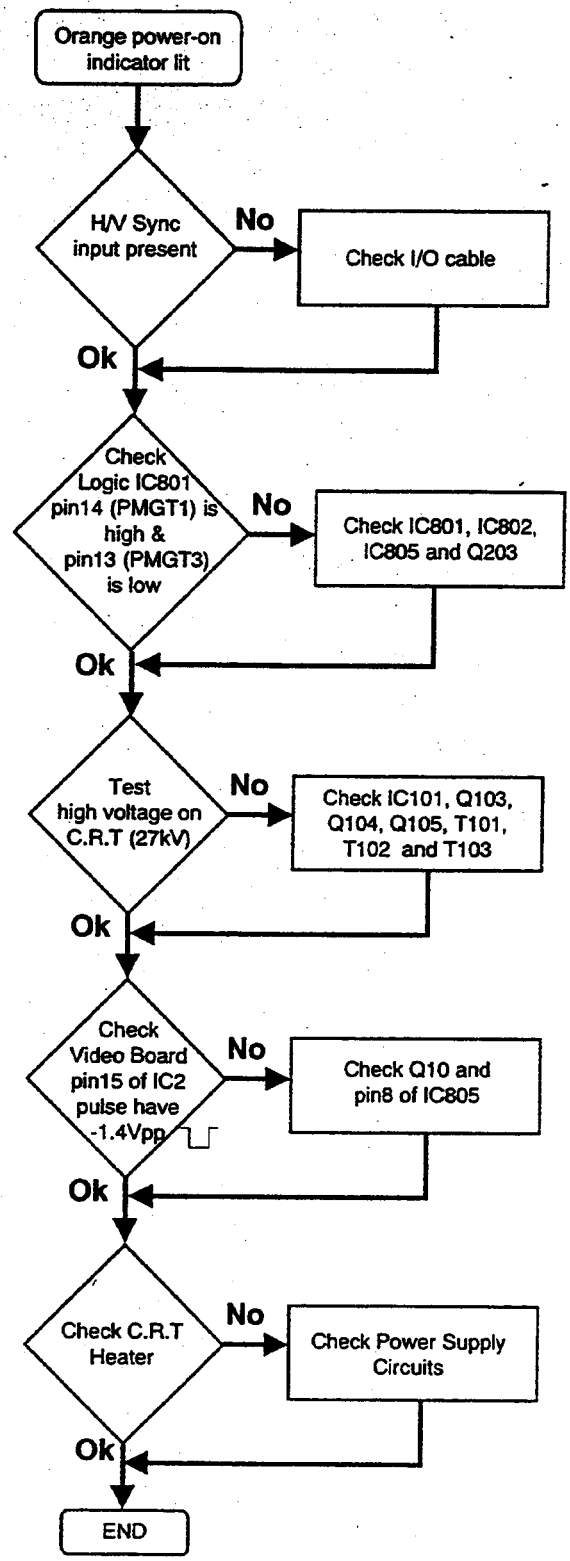
Writing the DDC 1/2 data in EEROM.

Notes

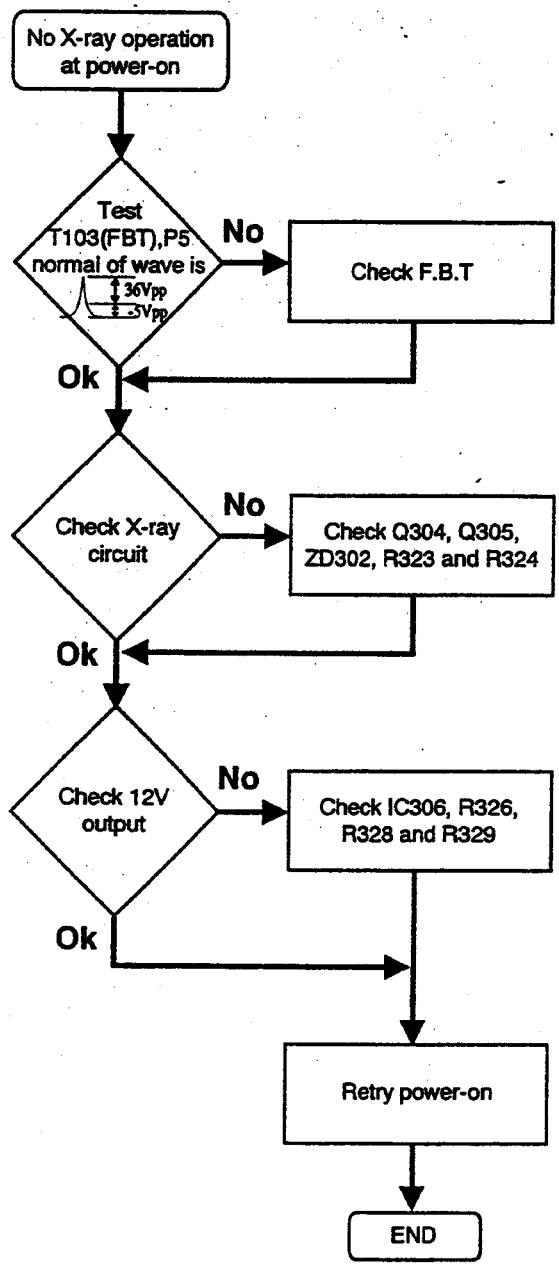
Section 5.
Troubleshooting

5.1. No Display at Power-on 5-1
5.2. No X-ray Operation 5-2
5.3. No Video Operation 5-3
5.4. Poor Vertical Linearity 5-4
5.5. Poor Horizontal Linearity 5-5
5.6. Poor Uniformity 5-6
5.7. Tilted Display Area 5-7
5.8. Misconvergence 5-8
5.9. Poor Regulation 5-9
5.10. Poor Focus 5-10
5.11. Poor Geometry Distortion 5-11

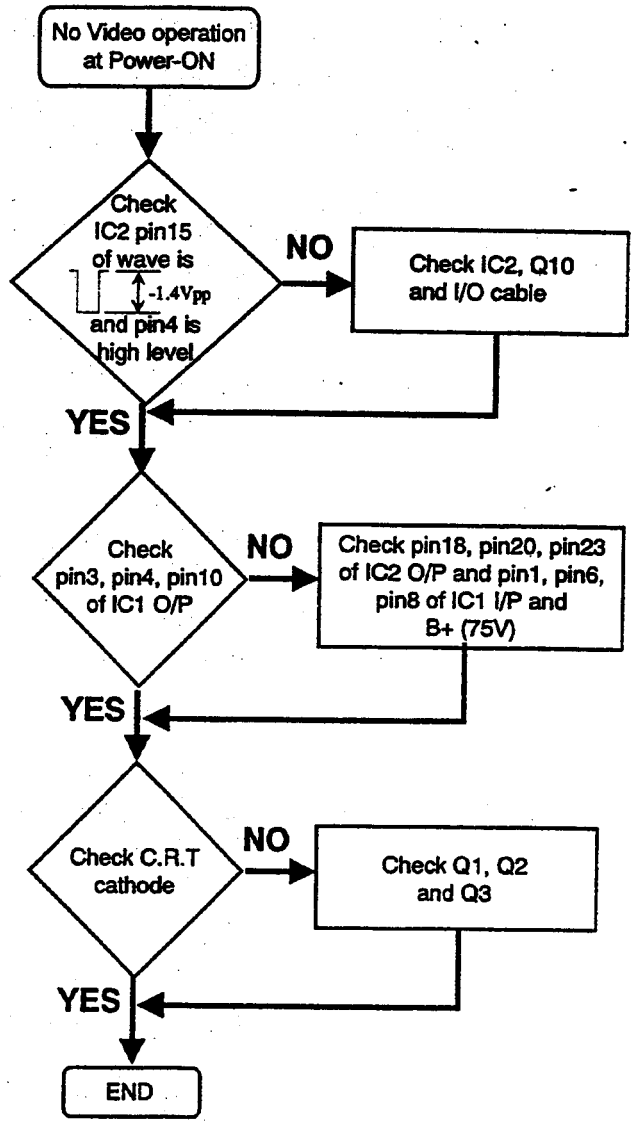
5.1. No Display at Power-on



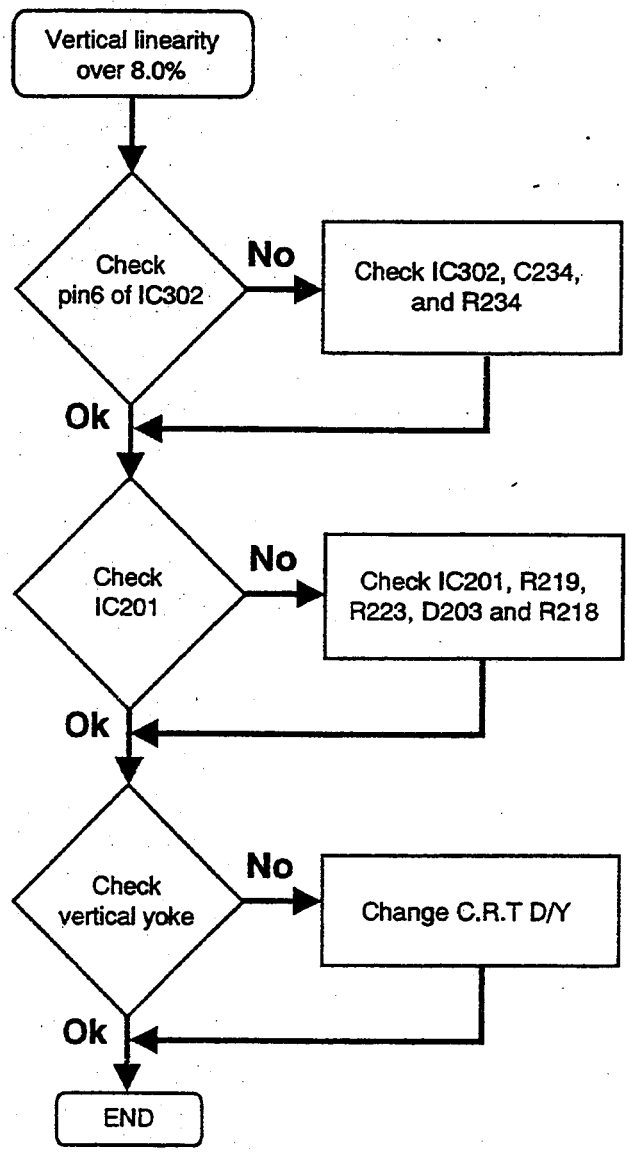
5.2. No X-ray Operation



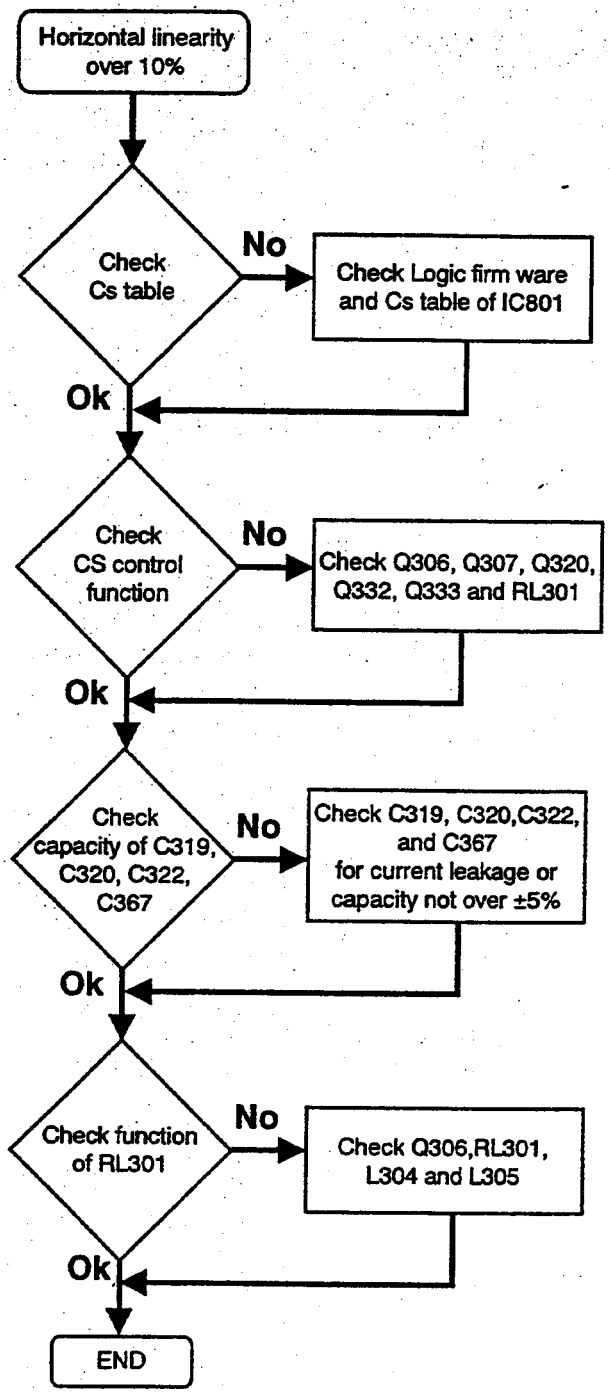
5.3. No Video Operation



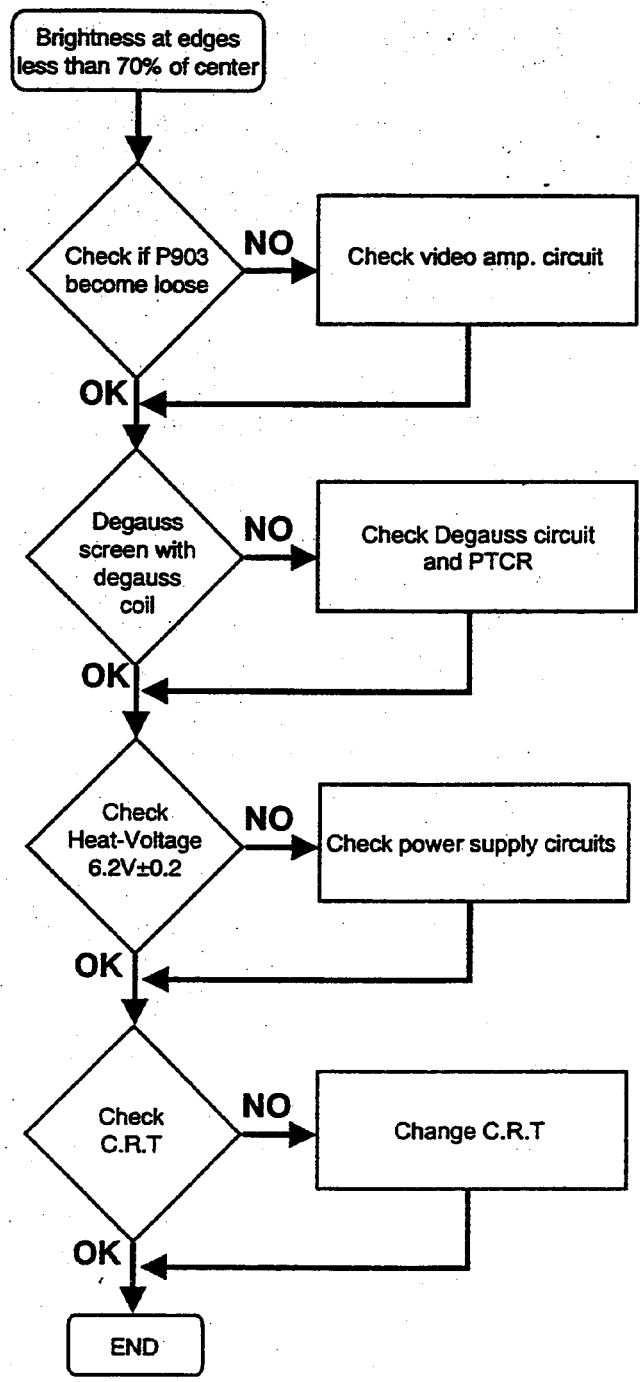
5.4. Poor Vertical Linearity



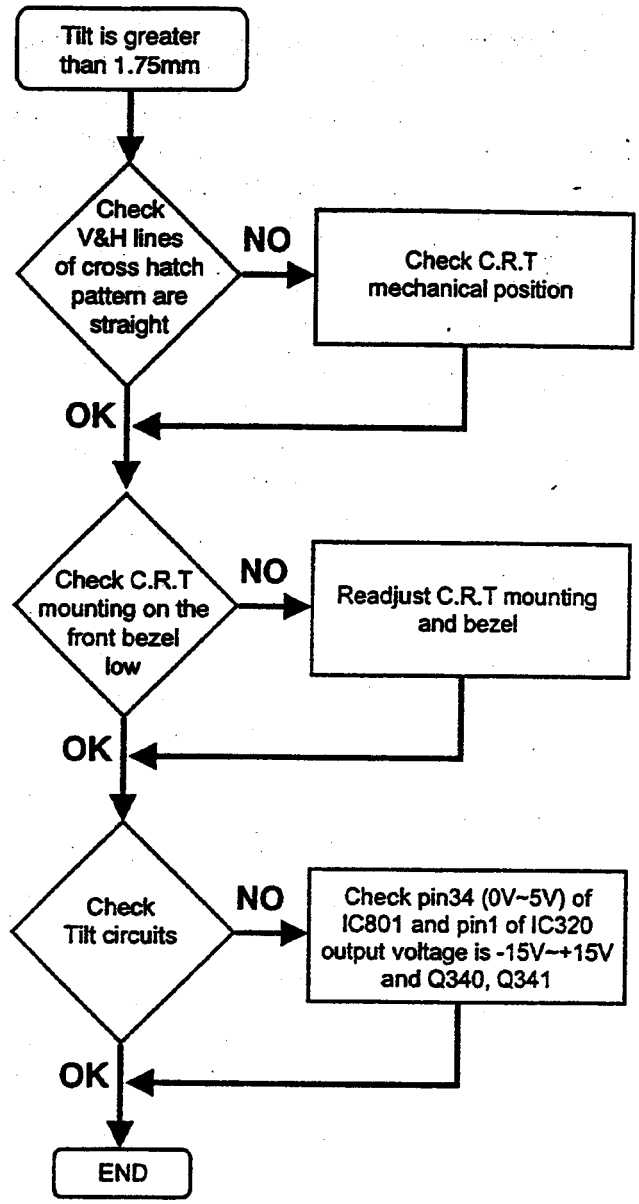
5.5. Poor Horizontal Linearity



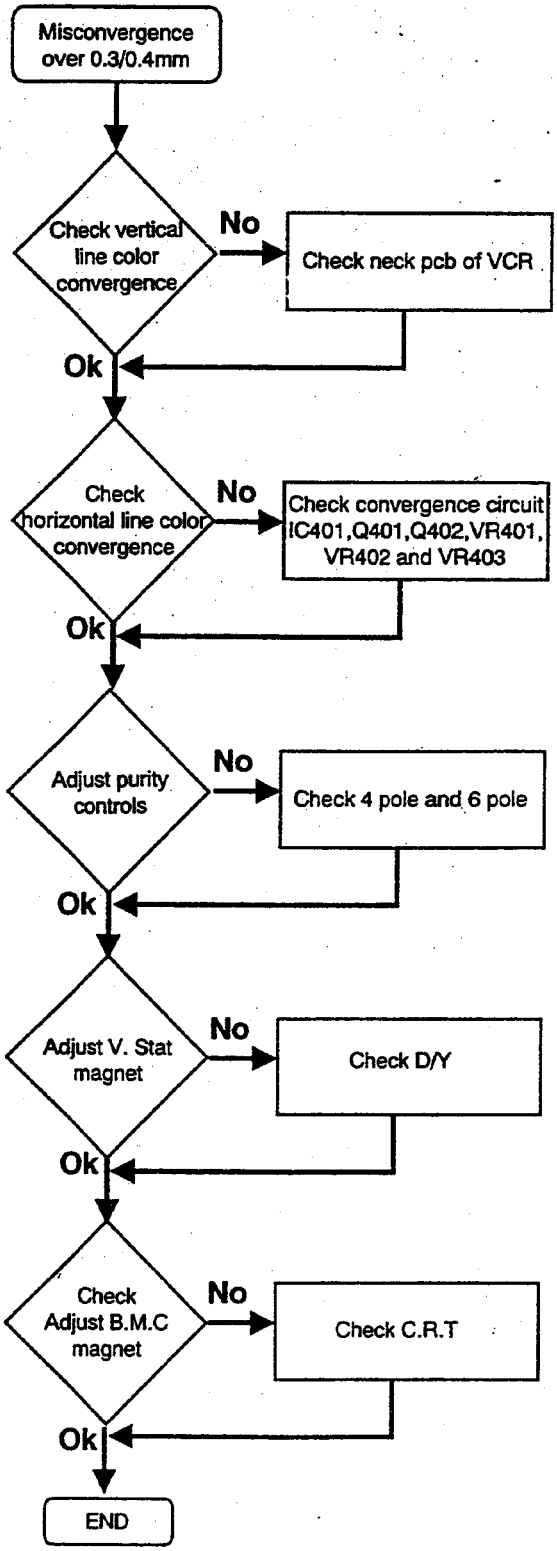
5.6. Poor Uniformity



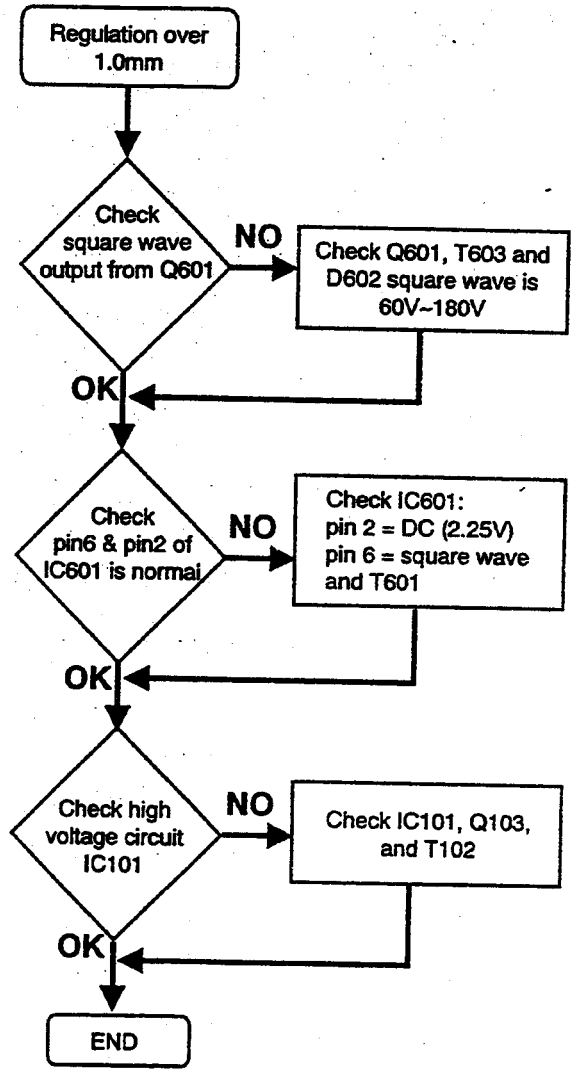
5.7. Tilted Display Area


Tilt is greater than 1.75mm
Check V&H lines of cross hatch pattern are straight
NO
Check C.R.T mechanical position
OK
Check C.R.T mounting on the front bezel low
NO
Readjust C.R.T mounting and bezel
OK
Check Tilt circuits
NO
Check pin34 (0V~5V) of IC801 and pin1 of IC320 output voltage is -15V~+15V and Q340, Q341
OK
END

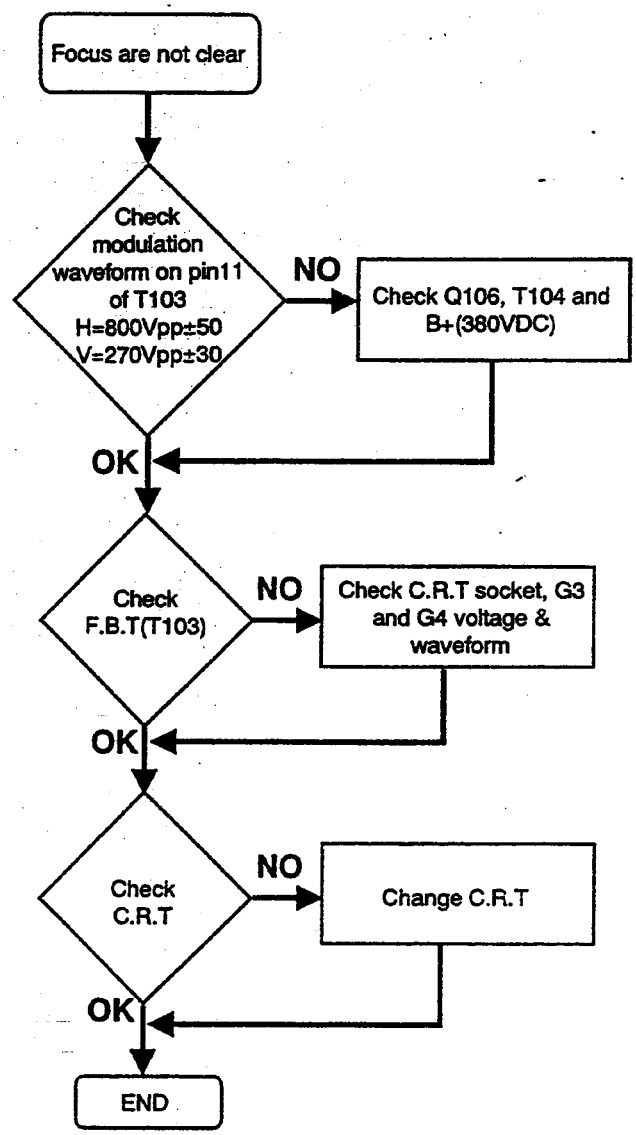
5.8. Misconvergence



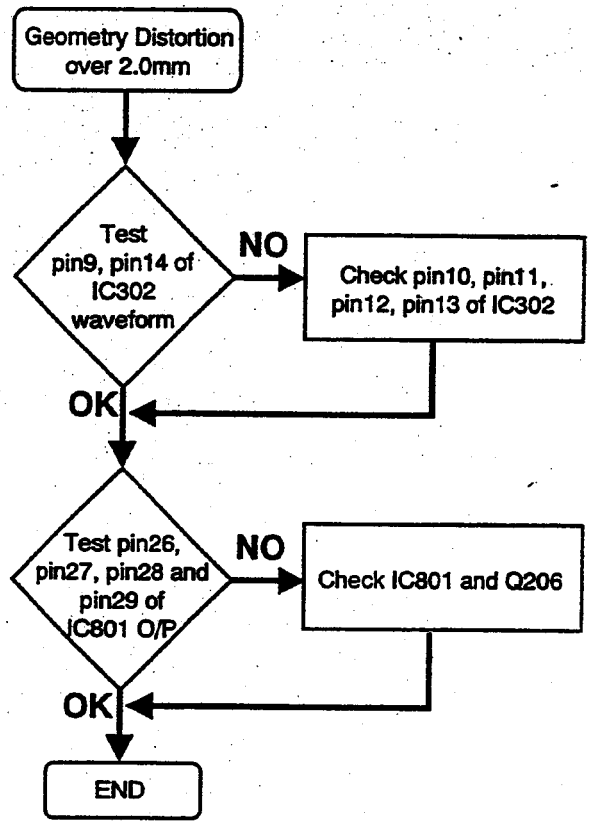
5.9. Poor Regulation


Regulation over 1.0mm
Check square wave output from Q601
NO
Check Q601, T603 and D602 square wave is 60V~180V
OK
Check pin6 & pin2 of IC601 is normal
NO
Check IC601: pin 2 = DC (2.25V) pin 6 = square wave and T601
OK
Check high voltage circuit IC101
NO
Check IC101, Q103, and T102
OK
END

5.10. Poor Focus



5.11. Poor Geometry Distortion



Section 6.
Printed Circuit Boards

6.1. Main Board 6-1
6.2. Neck Board 6-2
6.3. PCB Wiring Connection 6-3

6.1. Main Board

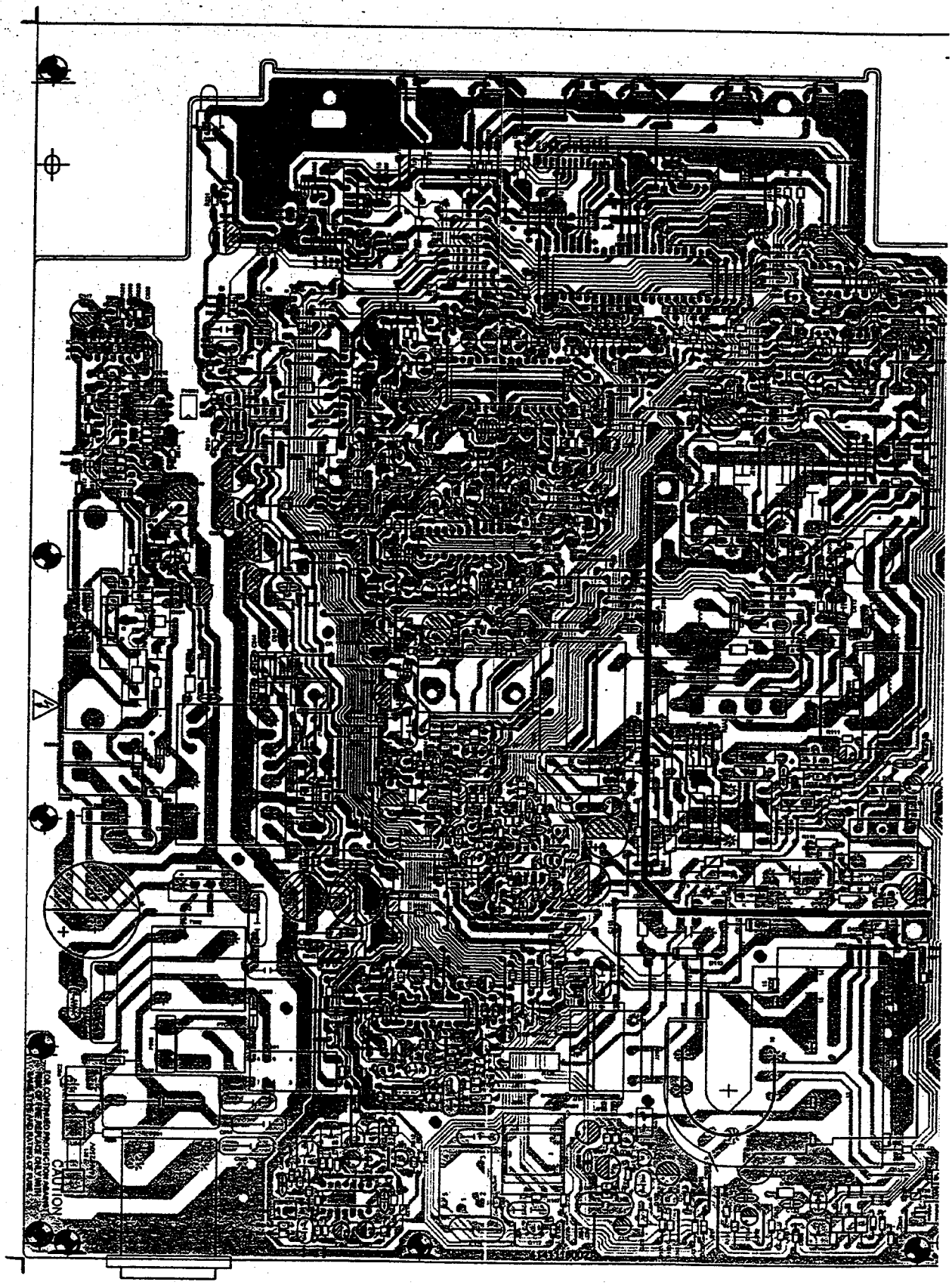


Figure 6-1 Main Board (Solder Side)

6.2. Neck Board

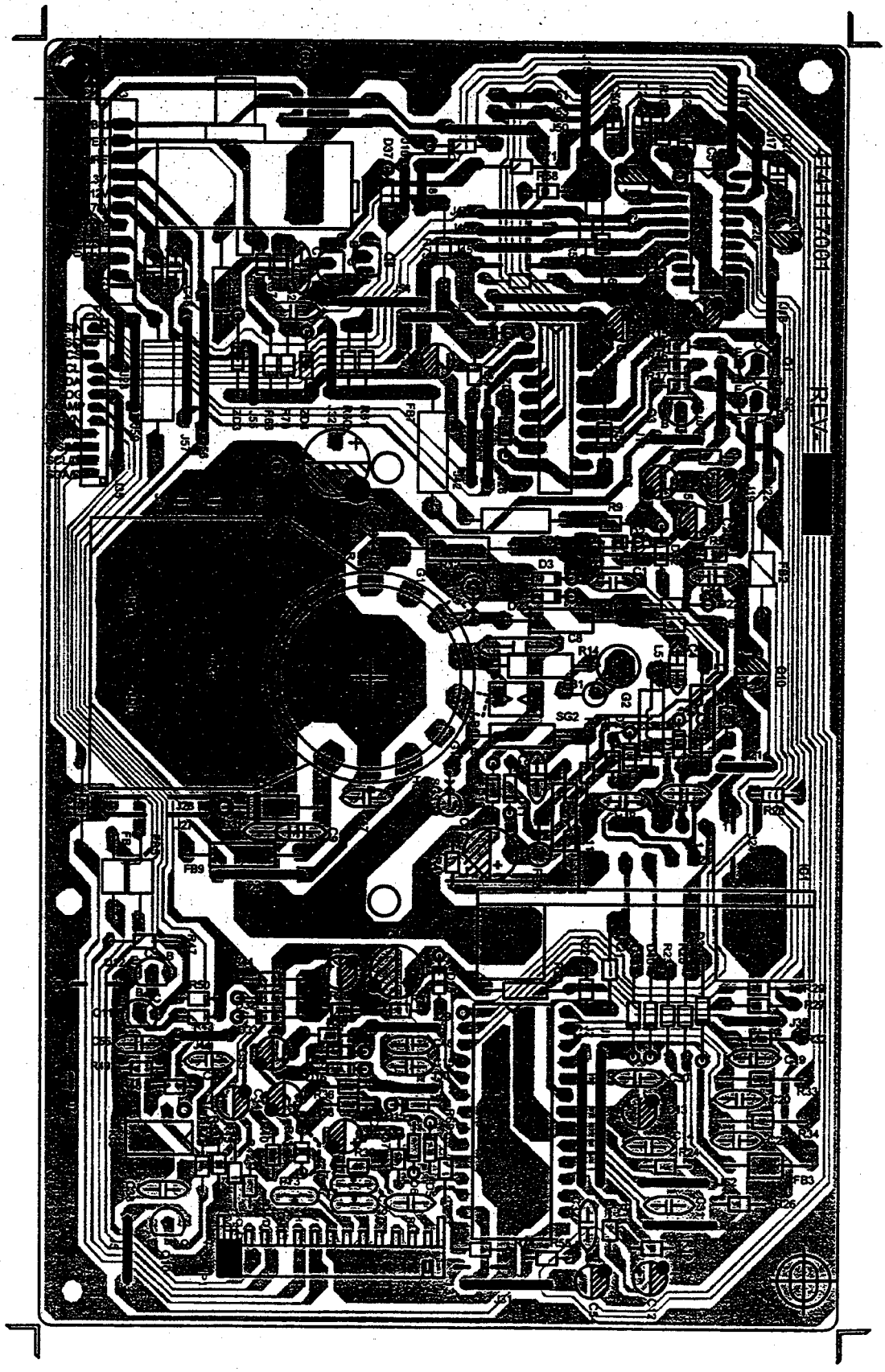


Figure 6-2 Neck Board (Solder Side)

6.3. PCB Wiring Connection

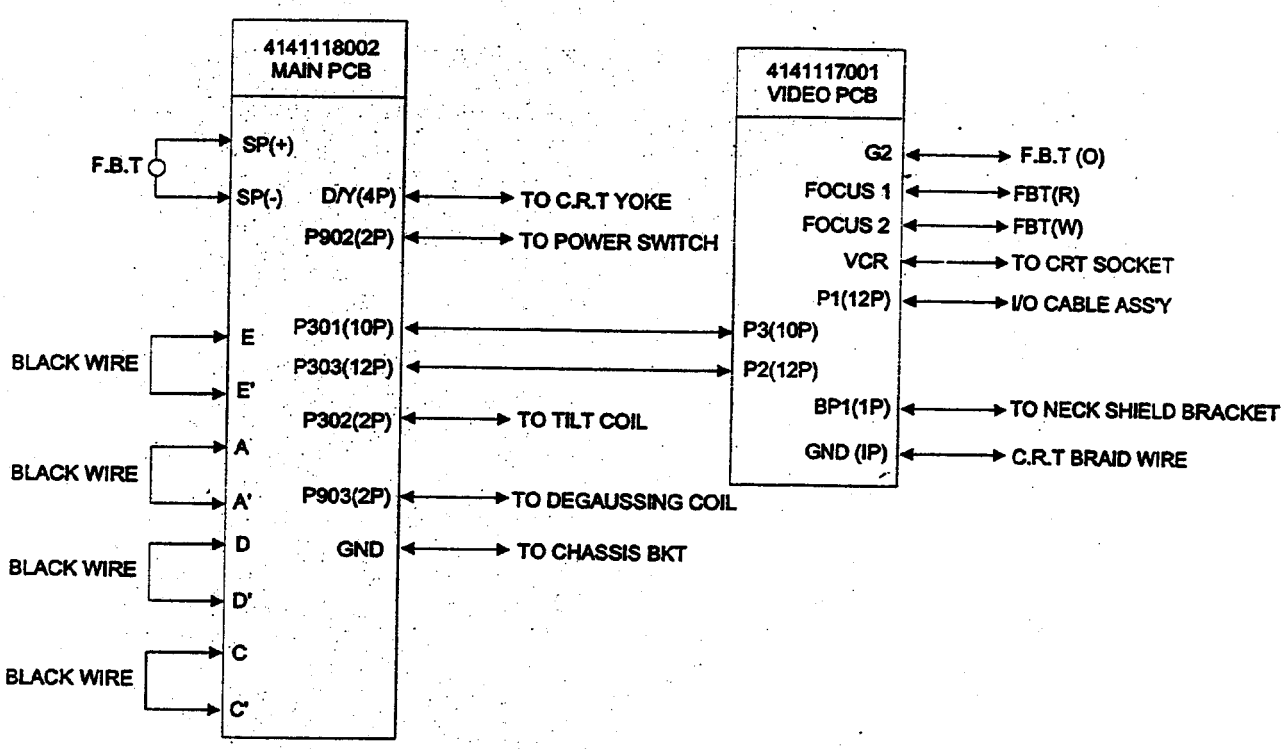


Figure 6-3 PCB Wiring Connection

Section 7.
Schematic Diagrams

7.1. Neck Circuit Diagram 7-1
7.2. MAIN Circuit Diagram 7-1

7.1. Neck Circuit Diagram

Please refer to the attached circuit diagram.

7.2. MAIN Circuit Diagram

Please refer to the attached circuit diagram.

Section 8.
Mechanical Parts

8.1. Exploded View. 8-1
8.2. Key to Exploded View 8-2

8.1. Exploded View

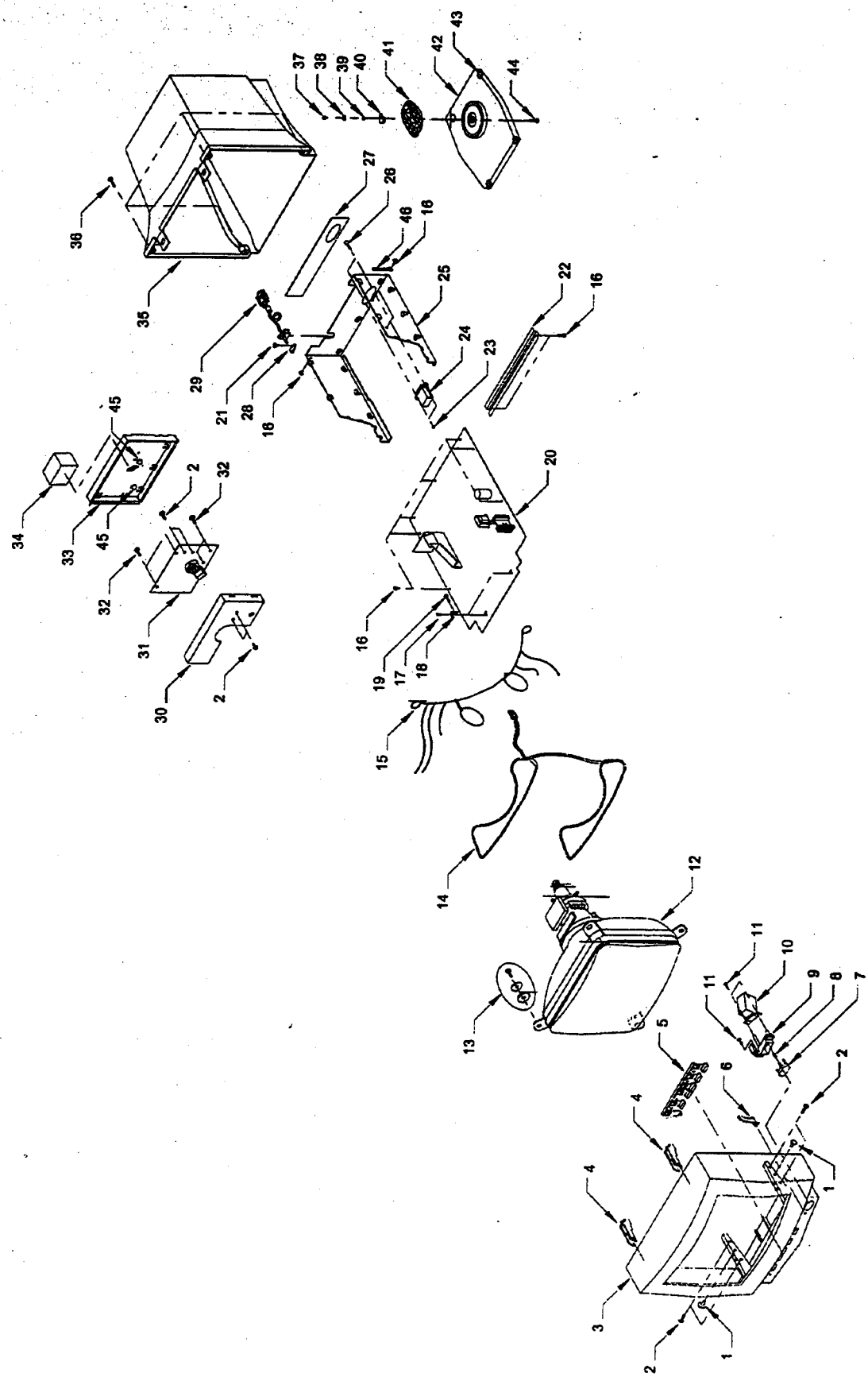


Figure 8-1 Exploded View

8.2. Key to Exploded View

REF.	PART NO.	DESCRIPTION
1	366230SR4S	NYLON RIVET SR-4S FOR BEZEL & U BKT
2	8026113008	SCREW B/HD M3X8 TAPPING "B" FOR BEZEL & U BKT X4
3	7010067F01	BEZEL
4	1176067F10	#BEZEL BRACKET
5	RHAK067H01	#FRANCKEY
6	4103067A10	#LENS
7	11A7067T10	#POWER KNOB
8	2011097K21	POWER SPRING
9	1150067T10	#POWER KNOB HOLDER
10	SS-4100520-104	SWITCH(DEGAUSS)W/WIRE ASS'Y
11	8418113010	SCREW BIND(+) TAPPING M3X10 ZI FOR PW SW HOLDER & BZL X1, PW SW &PW SW HOLDER X2
12	7010030617	#CRT-17SA2K(W/O CRT)
13	C367F10030	RUBBER WASHER & SCREW ASS'Y FOR CRT & BEZEL
14	7020177T10	DEGAUSSING COIL 17"
15	C001137T10	CRT BRAID WIRE ASS'Y
16	8127113006	SCREW PAN(+)/HD CAP TAPPING M3X6 FOR BKT SUPPORT & U BKT X2,GND WIRE X1
17	366230SR3M	SANP RIVET ¢3 FOR PCB FIXING PLATE & PCB
18	2003097T10	PCB FIXING PLATE
19	8026113012	SCREW B/HD M3X12 TAPPING "B" FOR PCB FIXING PLATE & BEZEL
20	RH-T110144-V1	MAIN PCB ASS'Y
21	8121114008	SCREW CAP BID(+) M4X8 TAPPING"
22	2002097T10	U BKT SUPPORT
23	3011100030	NUT ISO HEX M3 ZINC FOR AC LINE FILTER
24	7067F20122	LINE FILTER LX-0342-P-S
25	2001197H10	U BRACKET (I/O CABLE)
26	8504113010	SCREW BIND(+) M3X10 MACH W/DISK FOR FILTER & U BKT X2
27	9004097H11	DECO PLATE
28	2017094030	GROUND CLAMP
29	C7107T1010	I/O CABLE ASS'Y
30	2015097F10	NECK SHIELD (F)
31	RH-T110244-V1	NECK PCB ASS'Y
32	8504113008	SCREW BIND(+) M3X8 MACH W/DISK
33	2016097F10	NECK SHIELD (B)
34	9022097H10	UL SPONGE B
35	1102167F10	#BUCKET
36	8059113522	SCREW BIND(+) B-2 M3.5X22 TAPPING FOR BEZEL & BUCKET
37	3011100040	NUT M4 ZN3C FOR BASE & RETAINER
38	3111401210	WASHER FLAT #8O D=12 T=1 ZINC FOR BASE & RETAINER
39	2002094383	WASHER SPRING WAVE FOR BASE & RETAINER
40	1AI00C7F10	RETAINER
41	1104067F10	#TILT BALL
42	1105067F10	#BASE
43	1010094310	FOOT
44	8004114025	SCREW BIND (+) ZINC M4X25 FOR BASE & RETAINER
45	9004095G21	SPACER
46	2000000011	CLIP WIRE

Other parts list		
REF.	PART NO.	DESCRIPTION
	36723000A5	WIRE HOLDER A-5 FOR GROUND WIRE
	36723000A8	WIRE HOLDER A-8
	36823FW2C0	WIRE MOUNTS FOR DEGAUSSING COIL
	463310001N	AC POWER CORD WALL UL/CSA GRY
	5541036300	CABLE TIE 3.6X300MM FOR DEGAUSSING COIL
	8504113008	SCREW BIND(+) M3X8 MACH W/DISK FOR VIDEO PCB & NECK SHIELD (F)
	9012097T11	#MANUAL
	C4597F1021	GND WIRE ASS'Y 100MM FROM REAR PANNEL TO VIDEO SHIED & TOP SHIELD
	C4597T1010	GND WIRE ASS'Y 200MM FROM NECK SHIELD (FRONT) TO U BRACKET

Notes

Section 9.
PCB Component List

9.1. Explanation of Parts Listing. 9-1
9.2. RMH-7T11 Component List 9-1
9.3. RMH-7T12 Component List 9-7
9.4. RMH-7T13 Component List 9-9

9.1. Explanation of Parts Listing

This section contains a complete listing of the components used on the printed circuit boards contained in the system. For a listing of the mechanical parts, please refer to Section 8., Mechanical Parts.

The list of parts in this section is separated by PCB, and the order of the listing is based on the location reference (REF.) printed on the circuit board and shown in the schematics. Components without a reference location are listed at the beginning of each table in order of the part number, and the location reference of the part with which they are connected is given in the description.

For example:

	2003097301	HEAT SINK FOR Q1

shows Part No. 2003097301, which is connected or related to the components with a location reference of Q1.

Shaded items indicate comonents that are critical for safety or are of proprietary design and must be replaced with parts of the exact same specification or ordered directly from the manufacturer.

For example:

Q1	4101515070	TRS. MOSFET 2SK1507 TO-220

Indicates that the TRS. MOSFET, Part No. 4101515070 located at reference Q1, should onlybe replaced with the exact same part ordered from the manufacturer.

9.2. RMH-7T11 Component List

9.2.1. Main Board

REF. NO.	PART NO.	DESCRIPTION
	RH7T10144 EVR	MAIN PCB ASS'Y
	2000000011	CLIP WIRE FOR MAIN WIRE
	2000000011	CLIP WIRE FOR POWER WIRE
	2001197H10	U BRACKET (I/O CABLE)
	2003097T10	PCB FIXING PLATE
	2003197301	HEAT SINK FOR Q902
	2004097T10	HEAT SINK
	2004191630	HEAT SINK HOLDER FOR Q902
	2005197T10	#FBT COVER
	2008283080	HEAT SINK FOR D918
	2015097F10	NECK SHIELD (F)
	2017097T10	HEAT SINK FOR IC201
	2046294000	HEAT SINK F FOR IC306
	3011100030	NUT ISO HEX M3 Z1NC FOR AC LINE FILTER
	3011100030	NUT ISO HEX M3 Z1NC FOR Q105, Q303
	3340101525	BEAD PIN 1.5¢ L=25 FOR R901
	36223LEK02	LED HOLDER LEK2-4.5T FOR LD201
	366230SR3M	SANP RIVET ¢3 FOR PCB FIXING PLATE & PCB
	36723000A8	WIRE HOLDER A-8
	4141118003	#P.C.B. MAIN
	4692300001	CLIP-FUSE 5MM FOR F901
	5324100600	WIRE UL1007 #24 BLK 50-K-K FOR A-A',C-C',D-D'
	5324161600	WIRE UL1007 #24 BLU 150-K-K FOR E-E'
	5520100005	INSULATOR SI-RUBBER TO-3P FOR Q303
	5530200102	CORD CRAMPER TH-A
	5541025095	CABLE TIE 2.5X90
	555019S056	MISTIK TAPE 19mm FOR FBT COVER
	5560080003	CORE-FE 2643665802 FOR G2 FOCUS WIRE
	8026113006	SCREW B/HD M3X6 TAPPING "B" FOR PCB & Q902 HEAT SINK
	8026113008	SCREW B/HD M3X8 TAPPING "B" FOR HEAT SINK & FBT COVER
	8026113008	SCREW B/HD M3X8 TAPPING "B" FOR VIDEO SHIELD (F) & HEAT SINK ASS'Y
	8026113010	SCREW BIND(+) TAPPING M3X10 TR FOR IC201
	8127113006	SCREW PAN(+)/HD CAP TAPPING M3X6 FOR U BKT & MAIN PCB X7,CLIP WIRE & U BKT X2
	8128112608	SCREW B/H W/CAP "B" M2.6X8 TIT FOR CLIP WIRE & HEAT SINK
	8504113008	SCREW BIND(+) M3X8 MACH W/DISK FOR IC306
	8504113008	SCREW BIND(+) M3X8 MACH W/DISK FOR VIDEO PCB & NECK SHIELD(F)
	8504113010	SCREW BIND(+) M3X10 MACH W/DISK FOR D304,Q103,105,303,601
	8504113010	SCREW BIND(+) M3X10 MACH W/DISK FOR FILTER & U BKT X2
	8504113016	SCREW BID(+) MACH W/D ZINC M3X16 FOR Q902
	8512113008	SCREW BIND(+) TAPPING M3X8 FOR PCB & FBT COVER
	C4597T1020	GND WIRE ASS'Y
	C488121040	CONN. 10P & 12P & WIRE ASS'Y FOR P301 & P303
BD901	4130400080	DIODE-BRIDGE 4A/800V P:5.0MM
C101	5156339T50	CAP-EC6 3.3UFM 50V -RT-
C102	5074223101	CAP-MEF 0.022UFK 100V -SF-
C103	5156339T50	CAP-EC6 3.3UFM 50V -RT-
C104	5074104101	CAP-MEF 0.1UFK 100V -SF-
C105	5116104111	CAP-MC 0.1UFK 100V -RT-
C106	5128101552	CAP-CCSL 100PFJ 50V -RT-
C107	5156109T50	CAP-EC6 1UFM 50V -RT-
C108	5156101T16	CAP-EC6 100UFM 16V -RT-
C109	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C110	5156479T50	CAP-EC6 4.7UFM 50V -RT-
C112	5156101T25	CAP-EC6 100UFM 25V -RT-
C113	5128101552	CAP-CCSL 100PFJ 50V -RT-
C114	51901825A3	CAP-MPP 0.0018UFJ 2KV P:15MM -
C115	5190334583	CAP-MPP 0.33UFJ 250V -SF-
C116	5156220S03	CAP-EC6 22UFM 250V -SF-
C120	5092222565	CAP-PP 0.0022UFJ 630V P:10.0mm
C121	5156331T16	CAP-EC6 330UFM 16V -RT-
C122	5156470T25	CAP-EC6 47UFM 25V -RT-
C125	5074473104	CAP-MEF 0.047UFK 400V -SF-
C128	515X100S03	CAP-ECX 10UFM 250V -SF-
C130	5116104111	CAP-MC 0.1UFK 100V -RT-
C131	5074104506	CAP-MEF 0.1UFJ 630V P:10MM -SF
C132	5116104111	CAP-MC 0.1UFK 100V -RT-
C134	5101102132	CAP-CCB 1000PFK 1KV -RT-
C135	5116102111	CAP-MC 0.001UFK 100V -RT-
C136	5156331T16	CAP-EC6 330UFM 16V -RT-
C150	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C151	5134104452	CAP-SCF 0.1UFZ 50V -RT-

REF	PART NO	DESCRIPTION
C152	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C155	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C158	5156100T50	CAP-EC6 10UFM 50V -RT-
C201	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C202	5156100T16	CAP-EC6 10UFM 16V -RT-
C203	5156101T16	CAP-EC6 100UFM 16V -RT-
C204	5156479T50	CAP-EC6 4.7UFM 50V -RT-
C205	5156109T50	CAP-EC6 1UFM 50V -RT-
C206	5156100T16	CAP-EC6 10UFM 16V -RT-
C207	5156100T16	CAP-EC6 10UFM 16V -RT-
C208	5156479T50	CAP-EC6 4.7UFM 50V -RT-
C209	515X471S25	CAP-ECX 470UFM 25V -SF-
C210	515X221S35	CAP-ECX 220UFM 35V -SF-
C211	515X471S25	CAP-ECX 470UFM 25V -SF-
C212	5113224111	CAP-MC 0.22UFK 100V -SF-
C213	5116332111	CAP-MC 0.0033UFK 100V -RT-
C214	5113224111	CAP-MC 0.22UFK 100V -SF-
C215	5074104102	CAP-MEF 0.1UFK 250V -SF-
C216	515X471S16	CAP-ECX 470UFM 16V -SF-
C217	515X101T16	CAP-ECX 100UFM 16V -RT-
C218	5074474505	CAP-MP 0.47UFJ 50V P:5.0MM
C220	5116222111	CAP-MC 0.0022UFK 100V -RT-
C221	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C222	5128821552	CAP-CCSL 820PFJ 50V -RT-
C223	5128331552	CAP-CCSL 330PFJ 50V -RT-
C224	5156109T50	CAP-EC6 1UFM 50V -RT-
C225	5116333111	CAP-MC 0.033UFK 100V -RT-
C226	5156229T50	CAP-EC6 2.2UFM 50V -RT-
C227	5156109T50	CAP-EC6 1UFM 50V -RT-
C230	5101102152	CAP-CCB 1000PFK 50V -RT-
C231	5116122111	CAP-MC 0.0012UFM 100V -RT-
C232	5116104111	CAP-MC 0.1UFK 100V -RT-
C234	5156100T16	CAP-EC6 10UFM 16V -RT-
C235	5156331T16	CAP-EC6 330UFM 16V -RT-
C301	5156471T16	CAP-EC6 470UFM 16V -RT-
C302	5156102S16	CAP-EC6 1000UFM 16V -SF-
C303	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C304	5156109T50	CAP-EC6 1UFM 50V -RT-
C307	5116222111	CAP-MC 0.0022UFK 100V -RT-
C309	5156100T16	CAP-EC6 10UFM 16V -RT-
C310	5156221S16	CAP-EC6 220UFM 16V -SF-
C311	5116102111	CAP-MC 0.001UFK 100V -RT-
C312	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C313	5156221S16	CAP-EC6 220UFM 16V -SF-
C314	5156470T16	CAP-EC6 47UFM 16V -RT-
C315	5156109T50	CAP-EC6 1UFM 50V -RT-
C316	5195512573	CAP-PMHA 5100PFJ 1600V P:22.5m
C319	5195474543	CAP-PMHA 0.47UFJ 400V -SF-
C320	5190624583	CAP-MPP 0.62UFJ 250V P:22.5MM
C321	5074104102	CAP-MEF 0.1UFK 250V -SF-
C322	5190624583	CAP-MPP 0.62UFJ 250V P:22.5MM
C324	5156101T25	CAP-EC6 100UFM 25V -RT-
C325	5156101T25	CAP-EC6 100UFM 25V -RT-
C330	5101103152	CAP-CCB 0.01UFK 50V -RT-
C332	5156100T16	CAP-EC6 10UFM 16V -RT-
C333	5156100T16	CAP-EC6 10UFM 16V -RT-
C334	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C335	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C336	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C338	5156100T16	CAP-EC6 10UFM 16V -RT-

REF	PART NO	DESCRIPTION
C339	5156100T16	CAP-EC6 10UFM 16V -RT-
C340	5156109T50	CAP-EC6 1UFM 50V -RT-
C341	5156100T16	CAP-EC6 10UFM 16V -RT-
C343	5156109T50	CAP-EC6 1UFM 50V -RT-
C344	5116472111	CAP-MC 0.0047UFK 100V -RT-
C345	5116104111	CAP-MC 0.1UFK 100V -RT-
C346	5074474505	CAP-MP 0.47UFJ 50V P:5.0MM
C347	5156100T16	CAP-EC6 10UFM 16V -RT-
C348	5156100T16	CAP-EC6 10UFM 16V -RT-
C349	5075474563	CAP-MEF 0.47UFJ 63V P:5.0mm -R
C350	5156100T16	CAP-EC6 10UFM 16V -RT-
C351	5121330552	CAP-CCCH 33PFJ 50V -RT-
C352	5116104111	CAP-MC 0.1UFK 100V -RT-
C353	5116104111	CAP-MC 0.1UFK 100V -RT-
C360	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C361	5101681132	CAP-CCB 680PFK 1KV -RT-
C363	5116104111	CAP-MC 0.1UFK 100V -RT-
C365	5156100T16	CAP-EC6 10UFM 16V -RT-
C366	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C367	5190244543	CAP-MPP 0.24UFJ 400V P:22.5mm
C368	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C369	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C370	5116104111	CAP-MC 0.1UFK 100V -RT-
C371	5156100T16	CAP-EC6 10UFM 16V -RT-
C372	5116104111	CAP-MC 0.1UFK 100V -RT-
C373	5101101132	CAP-CCB 100PFK 1KV -RT-
C380	5101222142	CAP-CCB 2200PFK 500V -RT-
C381	510H221193	CAP-CCR 220PFK 3KV P:7.5mm -SF
C388	5156100T16	CAP-EC6 10UFM 16V -RT-
C389	5156470T25	CAP-EC6 47UFM 25V -RT-
C390	5156470T25	CAP-EC6 47UFM 25V -RT-
C391	5116104111	CAP-MC 0.1UFK 100V -RT-
C401	5156100T50	CAP-EC6 10UFM 50V -RT-
C406	5113224111	CAP-MC 0.22UFK 100V -SF-
C408	5156100T50	CAP-EC6 10UFM 50V -RT-
C409	5156100T50	CAP-EC6 10UFM 50V -RT-
C601	5156220S03	CAP-EC6 22UFM 250V -SF-
C604	5128101552	CAP-CCSL 100PFJ 50V -RT-
C605	5116222111	CAP-MC 0.0022UFK 100V -RT-
C606	5128471552	CAP-CCSL 470PFJ 50V -RT-
C607	5156100T16	CAP-EC6 10UFM 16V -RT-
C608	5116472111	CAP-MC 0.0047UFK 100V -RT-
C609	5116223111	CAP-MC 0.022UFK 100V -RT-
C610	5156100T16	CAP-EC6 10UFM 16V -RT-
C611	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C612	5116104111	CAP-MC 0.1UFK 100V -RT-
C613	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C614	5116333111	CAP-MC 0.033UFK 100V -RT-
C615	5156470T16	CAP-EC6 47UFM 16V -RT-
C801	5152109T50	CAP-EC2 1UFM 50V 4X7mm
C802	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C803	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C804	5152101T10	CAP-EC2 100UFM 10V 6X7mm -RT-
C805	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C806	5128390552	CAP-CCSL 39PFJ 50V -RT-
C807	5128390552	CAP-CCSL 39PFJ 50V -RT-
C808	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C810	5128221552	CAP-CCSL 220PFJ 50V -RT-
C811	5128221552	CAP-CCSL 220PFJ 50V -RT-
C814	5134104452	CAP-SCF 0.1UFZ 50V -RT-

REF	PART NO	DESCRIPTION
C815	5128101552	CAP-CCSL 100PFJ 50V -RT-
C816	5128101552	CAP-CCSL 100PFJ 50V -RT-
C817	5128681552	CAP-CCSL 680PFJ 50V -RT-
C902	5067[illegible]4425	CAP-MPR 0.22UFM 250V -SF-
C903	5061472440	CAP-CCS 4700PFM 400V -SF-
C904	5061472440	CAP-CCS 4700PFM 400V -SF-
C905	5061472440	CAP-CCS 4700PFM 400V -SF-
C906	5061472440	CAP-CCS 4700PFM 400V -SF-
C907	515F331S04	CAP-ECP 330UFM 400V -SF-
C908	5074104104	CAP-MEF 0.1UFK 400V P:15MM -SF
C909	510[illegible]4711C3	CAP-CCR 470PFK 2KV P:7.5mm -SF
C910	5156470T35	CAP-EC6 47UFM 35V -RT-
C911	5156470T01	CAP-EC6 47UFM 100V -RT-
C912	507[illegible]4103501	CAP-MEF 0.01UFJ 100V -SF-
C913	5128681552	CAP-CCSL 680PFJ 50V -RT-
C914	5128681552	CAP-CCSL 680PFJ 50V -RT-
C915	5156109T50	CAP-EC6 1UFM 50V -RT-
C916	5116472111	CAP-MC 0.0047UFK 100V -RT-
C917	5156101T16	CAP-EC6 100UFM 16V -RT-
C918	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C919	5075474563	CAP-MEF 0.47UFJ 63V P:5.0mm -R
C920	5128331552	CAP-CCSL 330PFJ 50V -RT-
C921	5074104101	CAP-MEF 0.1UFK 100V -SF-
C922	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C923	5156471S25	CAP-EC6 470UFM 25V -SF-
C924	5156471T16	CAP-EC6 470UFM 16V -RT-
C925	5156221S01	CAP-EC6 220UFM 100V -SF-
C926	515X221S02	CAP-ECX 220UFM 160V -SF-
C928	5156102S25	CAP-EC6 1000UFM 25V -SF-
C930	5156471T25	CAP-EC6 470UFM 25V -RT-
C931	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C932	5067474425	CAP-MPR 0.47UFM 250V -SF-
C936	5101332152	CAP-CCB 3300PFK 50V -RT-
C939	5101102132	CAP-CCB 1000PFK 1KV -RT-
C945	5101102132	CAP-CCB 1000PFK 1KV -RT-
C948	5156471S35	CAP-EC6 470UFM 35V -SF-
C951	5156100T16	CAP-EC6 10UFM 16V -RT-
C955	515X471S16	CAP-ECX 470UFM 16V -SF-
C956	5075474563	CAP-MEF 0.47UFJ 63V P:5.0mm -R
C957	5101102152	CAP-CCB 1000PFK 50V -RT-
C958	5061222440	CAP-CCS 2200PFM 400V
D101	4120141480	DIODE-1N4148 (SI) -AT-
D102	4120141480	DIODE-1N4148 (SI) -AT-
D103	4120141480	DIODE-1N4148 (SI) -AT-
D105	4120146060	DIODE-1N4606 (SI) -AT-
D107	4120141480	DIODE-1N4148 (SI) -AT-
D111	413020426C	DIODE-2.3A/600V-BYM26C-AT-
D112	4130104004	DIODE-UF4004-400V/1A-AT-
D113	413020426C	DIODE-2.3A/600V-BYM26C-AT-
D114	4130010212	DIODE-RGP02-12E-1200V/0.5A-AT-
D120	4120141480	DIODE-1N4148 (SI) -AT-
D121	4120141480	DIODE-1N4148 (SI) -AT-
D122	4120141480	DIODE-1N4148 (SI) -AT-
D123	413010010J	DIODE-RGP10J-5390-1A-600V-AT-
D124	413010010J	DIODE-RGP10J-5390-1A-600V-AT-
D125	4120141480	DIODE-1N4148 (SI) -AT-
D126	4120141480	DIODE-1N4148 (SI) -AT-
D130	413010010J	DIODE-RGP10J-5390-1A-600V-AT-
D131	4120141480	DIODE-1N4148 (SI) -AT-
D132	4120141480	DIODE-1N4148 (SI) -AT-

REF	PART NO	DESCRIPTION
D201	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D202	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D203	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D301	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D302	4120[illegible]480	DIODE-RGP10J-5390-1A-600V-AT-
D303	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D304	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D305	4130[illegible]480	DIODE-RGP10J-5390-1A-600V-AT-
D306	4130[illegible]480	DIODE-RGP10J-5390-1A-600V-AT-
D307	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D308	4130[illegible]480	DIODE-RGP10J-5390-1A-600V-AT-
D309	4130[illegible]480	DIODE-RGP10J-5390-1A-600V-AT-
D311	4120[illegible]480	DIODE-1N4148 (SI) -AT-
D312	4130[illegible]480	DIODE-1N4004-400V/1A-AT-
D313	4130[illegible]480	DIODE-RGP10J-5390-1A-600V-AT-
D401	4120141480	DIODE-SR4148 (SI) -AT-
D402	4120141480	DIODE-1N4148 (SI) -AT-
D403	4120141480	DIODE-1N4148 (SI) -AT-
D501	4120141480	DIODE-1N4148 (SI) -AT-
D502	4120141480	DIODE-1N4148 (SI) -AT-
D602	413030030F4	DIODE-30DF4-AT-
D603	4120141480	DIODE-1N4148 (SI) -AT-
D604	4120141K80	DIODE-1K4148 (SI) -AT-
D605	4120141480	DIODE-1N4148 (SI) -AT-
D606	4120141480	DIODE-1N4148 (SI) -AT-
D607	4120141480	DIODE-1N4148 (SI) -AT-
D608	4120141480	DIODE-1N4148 (SI) -AT-
D610	4120141480	DIODE-1N4148 (SI) -AT-
D612	4120141480	DIODE-1N4148 (SI) -AT-
D613	4120141480	DIODE-1N4148 (SI) -AT-
D614	4120141480	DIODE-1N4148 (SI) -AT-
D615	4120141480	DIODE-1N4148 (SI) -AT-
D616	4120141480	DIODE-1N4148 (SI) -AT-
D617	4120141480	DIODE-1N4148 (SI) -AT-
D905	413010426C	DIODE-BYV26C-KINK FORMING-AT-
D906	413010426C	DIODE-BYV26C-KINK FORMING-AT-
D907	4130101003	DIODE-SR1003-1A/200V-AT-
D908	4130101003	DIODE-SR1003-1A/200V-AT-
D909	4120141480	DIODE-1N4148 (SI) -AT-
D910	4120141480	DIODE-1N4148 (SI) -AT-
D911	4120141480	DIODE-1N4148 (SI) -AT-
D912	4120146060	DIODE-1N4606 (SI) -AT-
D913	4120141480	DIODE-1N4148 (SI) -AT-
D914	4120141480	DIODE-1N4148 (SI) -AT-
D915	413030031F4	DIODE-3A/400V-35NS-31DF4-AT-
D916	413030031F4	DIODE-3A/400V-35NS-31DF4-AT-
D918	413030031F2	DIODE-3A/200V-31DF2-
D919	413030431F1	DIODE-31DF1-AT-
D920	413030031F2	DIODE-3A/200V-31DF2-
D921	4120104001	DIODE-1N4001-AT-
D922	4120141480	DIODE-1N4148 (SI) -AT-
D924	4120104002	DIODE-1N4002-AT-
D925	413020426C	DIODE-2.3A/600V-BYM26C-AT-
D926	413020426C	DIODE-2.3A/600V-BYM26C-AT-
D927	4120146060	DIODE-1N4606 (SI) -AT-
D928	4120104002	DIODE-1N4002-AT-
D929	4120104002	DIODE-1N4002-AT-
D930	4130104120	DIODE-SB120-20V/1A-AT-
D931	4120141480	DIODE-1N4148 (SI) -AT-
DY	4490400207	CONN. 4P WAFER ROUND PIN

REF	PART NO	DESCRIPTION
F901	5268000052	FUSE 4A/250V/S
FB101	4322209046	FERRITE BEAD 2UH -AT-
FB102	4322209046	FERRITE BEAD 2UH -AT-
FB103	4322209046	FERRITE BEAD 2UH -AT-
FB601	4322209046	FERRITE BEAD 2UH -AT-
FB602	4322209046	FERRITE BEAD 2UH -AT-
FB603	4322209046	FERRITE BEAD 2UH -AT-
FB801	4322209046	FERRITE BEAD 2UH -AT-
FB803	4322209046	FERRITE BEAD 2UH -AT-
FB901	4322209046	FERRITE BEAD 2UH -AT-
FB902	4322209046	FERRITE BEAD 2UH -AT-
FB903	4322209046	FERRITE BEAD 2UH -AT-
IC101	4159435002	IC PQ05RF11 TE12L
IC201	4159835001	IC STR-W6756 FBI
IC301	4159835001	IC STR-W6756 FBI
IC302	4159835001	IC STR-W6756 FBI
IC303	4159835001	IC STR-W6756 FBI
IC304	4159835001	IC STR-W6756 FBI
IC401	4159835001	IC STR-W6756 FBI
IC501	4159835001	IC STR-W6756 FBI
IC502	4159835001	IC STR-W6756 FBI
IC601	4159835001	IC STR-W6756 FBI
IC602	4159835001	IC STR-W6756 FBI
IC603	4159835001	IC STR-W6756 FBI
IC604	4159835001	IC STR-W6756 FBI
IC605	4159835001	IC STR-W6756 FBI
IC901	4159835001	IC STR-W6756 FBI
IC902	4159835001	IC STR-W6756 FBI
IC903	4159835001	IC STR-W6756 FBI
L101	4321829006	COIL PEAKING 8.2UH -AT-
L103	4321151006	COIL PEAKING 150UH -AT-
L303	4323802003	CHOKE COIL 0.8mH
L304	708S207H10	COIL LINEARITY -SF-
L305	4323500003	COIL CHOKE 50UH -SF-
L306	4323809403	#CHOKE COIL 8mH
L309	4323802003	CHOKE COIL 0.8mH
L601	4321151006	COIL PEAKING 150UH -AT-
LD201	4120664630	LED LTL-4263-23 DS1-5 G/Y
P302	4490200140	CONN. 2P WAFER TOP B2B-EH
P401	4490200200	CONN. 2P WAFER E2B PH-K
P901	7067200122	LINE FILTER DC0342-P
P902	4490300190	CONN. 3.96 3P W/O PIN 2 -SF-
P903	4490200207	CONN. 2P WAFER ROUND PIN 10MM
PH901	4159435002	POTO COUPLER X'STER 4N35 W=10
PTCR	7021177T10	PTCR 9R
Q101	4110221205	TRS 2SC4120Y TO-92 RT
Q102	4110007330	TRS 2SA733 TO-92M RT
Q103	4110350196	TRS FS10KM-6 TO-220FN
Q104	4105906203	TRS MOSFET IRF620 TO-220
Q105	4100252905	TRS 2SC5296 TO-3PML
Q106	4100241064	TRS 2SC4106M W/MOUNTING KIT
Q107	4116612030	TRS RN1203 RT
Q108	4110007330	TRS 2SA733 TO-92M RT
Q109	4110105610	TRS 2SB561 TO-92 RT
Q110	4110007330	TRS 2SA733 TO-92M RT
Q111	4112409200	TRS KSP92 TO-92
Q112	4110209455	TRS 2SC945P TO-92 RT
Q114	4110007330	TRS 2SA733 TO-92M RT
Q202	4110306670	TRS 2SD667 TO-92M RT
Q203	4110209455	TRS 2SC945P TO-92 RT
Q204	4110209455	TRS 2SC945P TO-92 RT
Q205	4110209455	TRS 2SC945P TO-92 RT

REF	PART NO	DESCRIPTION
Q206	4110209455	TRS 2SC945P TO-92 RT
Q207	4116012030	TRS RN1203
Q302	4110209455	TRS 2SC945P TO-92 RT
Q303	4100252905	TRS 2SC5296 TO-3PML
Q304	4110209455	TRS 2SC945P TO-92 RT
Q305	4110209455	TRS 2SC945P TO-92 RT
Q306	4110209455	TRS 2SC945P TO-92 RT
Q307	4116012030	TRS RN1203 RT
Q308	4110209455	TRS 2SC945P TO-92 RT
Q309	4110209455	TRS 2SC945P TO-92 RT
Q312	4110209455	TRS 2SC945P TO-92 RT
Q320	4116012030	TRS RN1203 RT
Q322	4116012030	TRS RN1203 RT
Q338	4110350196	TRS FS10KM-6 TO-220FN
Q340	4110306670	TRS 2SD667 TO-92M RT
Q341	4110106470	TRS 2SB647 TO-92M RT
Q401	4110306670	TRS 2SD667 TO-92M RT
Q402	4110106470	TRS 2SB647 TO-92M RT
Q601	4110503196	TRS FS10KM-6 TO-220FN
Q602	4110007330	TRS 2SA733 TO-92M RT
Q603	4110389403	TRS 2N3904 TO-92 RT
Q604	4110209455	TRS 2SC945P TO-92 RT
Q605	4110389003	TRS 2N3906 TO-92 RT
Q606	4116612030	TRS RN1203 RT
Q801	4110209455	TRS 2SC945P TO-92 RT
Q802	4110209455	TRS 2SC945P TO-92 RT
Q901	4110306690	TRS 2SD669A TO-126
Q902	4110350196	TRS FS10KM-6 TO-220F
Q903	4110501006	TRS MCB100-6 TO-92 RT
Q904	4110105610	TRS 2SB561 TO-92 RT
Q905	4116612030	TRS RN1203 RT
Q906	4110306690	TRS 2SD669A TO-126
Q915	4110209455	TRS 2SC945P TO-92 RT
R101	4050530255	RES-CF 1/4W J 3K -AT- SMALL
R102	4050530255	RES-CF 1/4W J 3K -AT- SMALL
R103	4257041403	RES-PR MF 1/4W F 140K SMALL -A
R104	4050551255	RES-CF 1/4W J 5.1K -AT- SMALL
R105	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R106	4050551255	RES-CF 1/4W J 5.1K -AT- SMALL
R107	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R108	4050533255	RES-CF 1/4W J 3.3K -AT- SMALL
R109	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R110	4050524055	RES-CF 1/4W J 24R SMALL -AT-
R111	4050520255	RES-CF 1/4W J 2K -AT- SMALL
R112	4050513155	RES-CF 1/4W J 130R SMALL -AT-
R113	4180410955	RES-FUSIBLE 1/4W J 1R -AT-
R114	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R115	4172082053	RES-MOF 2W J 82R -AT-
R116	4050133955	RES-CF 1/2W J 3.3R -AT- SMALL
R117	4050110155	RES-CF 1/2W J 100R SMALL -AT-
R118	4050120455	RES-CF 1/2W J 200K SMALL -AT-
R119	4050530455	RES-CF 1/4W J 300K SMALL -AT-
R120	4050543455	RES-CF 1/4W J 430K SMALL -AT-
R121	4050527255	RES-CF 1/4W J 2.7K -AT- SMALL
R123	4050510055	RES-CF 1/4W J 10R -AT- SMALL
R125	4050556155	RES-CF 1/4W J 560R -AT- SMALL
R129	4172033053	RES-MOF 2W J 33R -SF-
R130	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R131	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R132	4050522555	RES-CF 1/4W J 2.2M SMALL -AT-

R133	4050512355	RES-CF 1/4W J 12K -AT- SMALL
R136	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R138	4050512455	RES-CF 1/4W J 120K -AT- SMALL
R139	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R140	4050536355	RES-CF 1/4W J 36K -AT- SMALL
R145	4050524355	RES-CF 1/4W J 24K -AT- SMALL
R146	4050515355	RES-CF 1/4W J 15K -AT- SMALL
R147	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R150	4050115955	RES-CF 1/2W J 1.5R -AT- SMALL
R151	4050133155	RES-CF 1/2W J 330R -AT- SMALL
R153	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R154	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R156	4050513455	RES-CF 1/4W J 130K SMALL -AT-
R157	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R161	4050520255	RES-CF 1/4W J 2K -AT- SMALL
R201	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R202	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R203	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R204	4050575455	RES-CF 1/4W J 750K SMALL -AT-
R205	4050511355	RES-CF 1/4W J 11K SMALL -AT-
R206	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R207	4050520455	RES-CF 1/4W J 200K -AT- SMALL
R208	4050520255	RES-CF 1/4W J 2K -AT- SMALL
R209	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R210	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R212	4050536355	RES-CF 1/4W J 36K -AT- SMALL
R213	4050536355	RES-CF 1/4W J 36K -AT- SMALL
R214	4050547455	RES-CF 1/4W J 470K SMALL -AT-
R216	4257048251	RES-PR MF 1/4W F 8.25K AT SMAL
R219	4257044752	RES-PR MF 1/4W F 47.5K AT SMAL
R220	4050512955	RES-CF 1/4W J 1.2R SMALL -AT-
R221	4050133455	RES-CF 1/2W J 330K SMALL -AT-
R223	4171015956	RES-MOF 1W J 1.5R -AT-
R224	4257041502	RES-PR MF 1/4W F 15K AT SMALL
R225	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R226	4050110255	RES-CF 1/2W J 1K SMALL -AT-
R227	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R228	4050122255	RES-CF 1/2W J 2.2K SMALL -AT-
R229	4050510055	RES-CF 1/4W J 10R -AT- SMALL
R230	4172010953	RES-MOF 2W J 91R SMALL -AT-
R231	4050551155	RES-CF 1/4W J 510R SMALL -AT-
R232	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R233	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R234	4257048452	RES-PR MF 1/4W F 84.5K SMALL -
R235	4050591355	RES-CF 1/4W J 91K SMALL -AT-
R236	4257041502	RES-PR MF 1/4W F 15K AT SMALL
R237	4050582255	RES-CF 1/4W J 8.2K -AT- SMALL
R238	4050568155	RES-CF 1/4W J 680R SMALL -AT-
R239	4050513355	RES-CF 1/4W J 13K SMALL -AT-
R240	4050522455	RES-CF 1/4W J 220K SMALL -AT-
R241	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R242	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R243	4050515355	RES-CF 1/4W J 15K -AT- SMALL
R244	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R245	4050575355	RES-CF 1/4W J 75K SMALL -AT-
R246	4257049532	RES-PR MF 1/4W F 95.3K AT SMAL
R247	4257041693	RES-PR MF 1/4W F 169K SMALL -A
R248	4050543955	RES-CF 1/4W J 4.3R SMALL -AT-
R301	4257042372	RES-PR MF 1/4W F 23.7K SMALL -
R302	4257042672	RES-PR MF 1/4W F 26.7K AT SMAL
R303	4257042552	RES-PR MF 1/4W F 25.5K AT SMAL
R304	4050518355	RES-CF 1/4W J 18K SMALL -AT-
R305	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R306	4050520255	RES-CF 1/4W J 2K -AT- SMALL
R307	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R310	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R311	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R312	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R315	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R316	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R317	4171024156	RES-MOF 1W J 240R -AT-
R318	4050513355	RES-CF 1/4W J 13K SMALL -AT-
R319	4050513355	RES-CF 1/4W J 13K SMALL -AT-
R323	4257041502	RES-PR MF 1/4W F 15K AT SMALL
R324	4257045761	RES-PR MF 1/4W F 5.76K SMALL -
R325	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R326	4257043651	RES-PR MF 1/4W F 3.65K AT SMAL
R327	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R328	4257044320	RES-PR MF 1/4W F 432R SMALL -A
R329	4257042402	RES-PR MF 1/4W F 24K AT SMALL
R330	4172015653	RES-MOF 2W J 100R SMALL -AT-
R331	4257041004	RES-PR MF 1/4W F 1M SMALL -AT-
R332	4050547355	RES-CF 1/4W J 47K -AT- SMALL
R333	4171010256	RES-MOF 1W J 1K -AT-
R334	4172015653	RES-MOF 2W J 100R SMALL -AT-
R335	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R336	4171010456	RES-MOF 1W J 100K -AT-
R346	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R347	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R348	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R349	4050568355	RES-CF 1/4W J 68K -AT- SMALL
R350	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R351	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R353	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R354	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R355	4050547355	RES-CF 1/4W J 47K -AT- SMALL
R356	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R357	4050536355	RES-CF 1/4W J 36K -AT- SMALL
R358	4050522155	RES-CF 1/4W J 220R SMALL -AT-
R359	4050556455	RES-CF 1/4W J 560K SMALL -AT-
R360	4050515355	RES-CF 1/4W J 15K -AT- SMALL
R361	4050539255	RES-CF 1/4W J 3.9K -AT- SMALL
R362	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R363	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R364	4050582255	RES-CF 1/4W J 8.2K -AT- SMALL
R366	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R368	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R369	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R370	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R371	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R380	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R383	4050110455	RES-CF 1/2W J 100K SMALL -AT-
R386	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R388	4050110455	RES-CF 1/2W J 100K SMALL -AT-
R390	4050520355	RES-CF 1/4W J 20K -AT- SMALL
R391	4050518455	RES-CF 1/4W J 180K SMALL -AT-
R392	4050516455	RES-CF 1/4W J 160K SMALL -AT-
R393	4050510155	RES-CF 1/4W J 100R -AT- SMALL

REF	PART NO	DESCRIPTION
R398	4172033853	RES-MOF 2W J 33K -SF-
R399	4050515355	RES-CF 1/4W J 15K -AT- SMALL
R3A1	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R3A2	4050133055	RES-CF 1/2W J 33R SMALL -AT-
R3A3	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R3A4	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R3A5	4050591355	RES-CF 1/4W J 91K SMALL -AT-
R3A6	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R3A8	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R3A9	4257042552	RES-PR MF 1/4W F 25.5K AT SMAL
R3B3	4050568255	RES-CF 1/4W J 6.8K SMALL -AT-
R3B4	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R3B5	4257041002	RES-PR MF 1/4W F 10K AT SMALL
R3B6	4050524255	RES-CF 1/4W J 2.4K SMALL -AT-
R3B7	4050513355	RES-CF 1/4W J 13K SMALL -AT-
R3B8	4050582255	RES-CF 1/4W J 8.2K -AT- SMALL
R401	4050551255	RES-CF 1/4W J 5.1K -AT- SMALL
R402	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R403	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R404	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R406	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R408	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R409	4050513355	RES-CF 1/4W J 13K SMALL -AT-
R410	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R412	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R413	4050562055	RES-CF 1/4W J 62R SMALL -AT-
R414	4050562255	RES-CF 1/4W J 6.2K -AT- SMALL
R415	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R416	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R417	4050518155	RES-CF 1/4W J 180R SMALL -AT-
R601	4050522955	RES-CF 1/4W J 2.2R SMALL -AT-
R602	4050518255	RES-CF 1/4W J 1.8K -AT- SMALL
R603	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R604	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R605	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R606	4050539255	RES-CF 1/4W J 3.9K -AT- SMALL
R607	4050533355	RES-CF 1/4W J 33K SMALL -AT-
R608	4050512455	RES-CF 1/4W J 120K -AT- SMALL
R609	4050522355	RES-CF 1/4W J 22K SMALL -AT-
R610	4050527355	RES-CF 1/4W J 27K -AT- SMALL
R611	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R612	4050539255	RES-CF 1/4W J 3.9K -AT- SMALL
R613	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R614	4050547355	RES-CF 1/4W J 47K -AT- SMALL
R615	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R616	4050182055	RES-CF 1/2W J 82R SMALL -AT-
R617	4050510055	RES-CF 1/4W J 10R -AT- SMALL
R618	4050568255	RES-CF 1/4W J 6.8K SMALL -AT-
R619	4050168155	RES-CF 1/2W J 680R -AT- SMALL
R620	4050551155	RES-CF 1/4W J 510R SMALL -AT-
R801	4050551055	RES-CF 1/4W J 51R -AT- SMALL
R802	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R803	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R804	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R805	4050575255	RES-CF 1/4W J 7.5K -AT- SMALL
R806	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R807	4050575155	RES-CF 1/4W J 750R SMALL -AT-
R808	4050520255	RES-CF 1/4W J 2K -AT- SMALL
R809	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R810	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL

REF	PART NO	DESCRIPTION
R811	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R812	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R813	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R814	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R815	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R816	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R817	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R818	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R821	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R822	4050575155	RES-CF 1/4W J 750R SMALL -AT-
R823	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R901	4050100355	THMFR W 15% 10R/5A/15CW/KINK
R902	4171033856	RES-MOF 1W J 0.33R -AT-
R904	4172036353	RES-MOF 2W J 36K -SF-
R910	4172036353	RES-MOF 2W J 36K -SF-
R905	4095010355	RES-WW 5W J 0.1R
R906	4095620255	RES-WW 5W J 2K -SQ-A
R907	4050124355	RES-CF 1/2W J 24K -AT- SMALL
R908	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R909	4050527255	RES-CF 1/4W J 2.7K -AT- SMALL
R911	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R912	4257047321	RES-PR MF 1/4W F 7.32K SMALL -
R914	4172033853	RES-MOF 2W J 0.33R -SF-
R915	4050530255	RES-CF 1/4W J 3K -AT- SMALL
R916	4050520255	RES-CF 1/4W J 2K -AT- SMALL
R918	4050551255	RES-CF 1/4W J 5.1K -AT- SMALL
R919	4050556557	RES-CF 1/4W J 5.6M SMALL -AT-
R920	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R921	4050551255	RES-CF 1/4W J 5.1K -AT- SMALL
R922	4050551255	RES-CF 1/4W J 5.1K -AT- SMALL
R923	4050524055	RES-CF 1/4W J 24R SMALL -AT-
R924	4050575155	RES-CF 1/4W J 750R SMALL -AT-
R925	4050575055	RES-CF 1/4W J 75R -AT- SMALL
R926	4050556255	RES-CF 1/4W J 5.6K -AT- SMALL
R927	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R928	4257048061	RES-PR MF 1/4W F 8.06K SMALL -
R929	4050591255	RES-CF 1/4W J 9.1K SMALL -AT-
R930	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R931	4050522155	RES-CF 1/4W J 220R SMALL -AT-
R932	4050522155	RES-CF 1/4W J 220R SMALL -AT-
R933	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R934	4050515355	RES-CF 1/4W J 15K -AT- SMALL
R935	4050522155	RES-CF 1/4W J 220R SMALL -AT-
R936	4050547155	RES-CF 1/4W J 470R SMALL -AT-
R937	4257048872	RES-PR MF 1/4W F 88.7K SMALL -
R938	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R939	4257041652	RES-PR MF 1/4W F 16.5K SMALL -
R940	4257043651	RES-PR MF 1/4W F 3.65K AT SMAL
R949	4172033353	RES-MOF 2W J 33K -SF-
R955	4050562055	RES-CF 1/4W J 62R SMALL -AT-
R956	4050118555	RES-CF 1/2W J 1.8M SMALL -AT-
R957	4050520555	RES-CF 1/4W J 2M SMALL -AT-
R958	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R959	4050110555	RES-CF 1/2W J 1M SMALL -AT-
R960	4180251055	RES-FUSIBLE 1/2W J 51R -AT-
R962	4180251055	RES-FUSIBLE 1/2W J 51R -AT-
R964	4050520555	RES-CF 1/4W J 2M SMALL -AT-
R965	4180251055	RES-FUSIBLE 1/2W J 51R -AT-
R968	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
RL101	4420412002	RELAY 12V

REF	PART NO	DESCRIPTION
RL301	4420412009	RELAY JW2aHN-DC12V
RL901	4420412009	RELAY JW2aHN-DC12V
RN802	4082094725	RES-NET 9P J 4.7K COMMON
RN803	4082074725	RES-NET 7P J 4.7K COMMON
S801	4410604038	KEY SWITCH SKHHLN1520 1KEY
S802	4410604038	KEY SWITCH SKHHLN1520 1KEY
S803	4410604038	KEY SWITCH SKHHLN1520 1KEY
S804	4410604038	KEY SWITCH SKHHLN1520 1KEY
S805	4410604038	KEY SWITCH SKHHLN1520 1KEY
S806	4410604038	KEY SWITCH SKHHLN1520 1KEY
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
VR101	5225110410	POT(CERMET) 0.3W 100K 6¢ LAY-D
VR102	5221150300	POT(CERMET) 0.3W 50K 6¢ STAND-
VR106	5225150310	POT(CERMET) 0.3W 50K 6¢ LAY-DO
VR107	5225125410	POT(CERMET) 0.3W 250K 6¢ LAY-D
VR401	5225110410	POT(CERMET) 0.3W 100K 6¢ LAY-D
VR402	5225110410	POT(CERMET) 0.3W 100K 6¢ LAY-D
VR403	5225110410	POT(CERMET) 0.3W 100K 6¢ LAY-D
X801	7154000005	CRYSTAL 4.00MHz
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

9.2.2. Neck Board

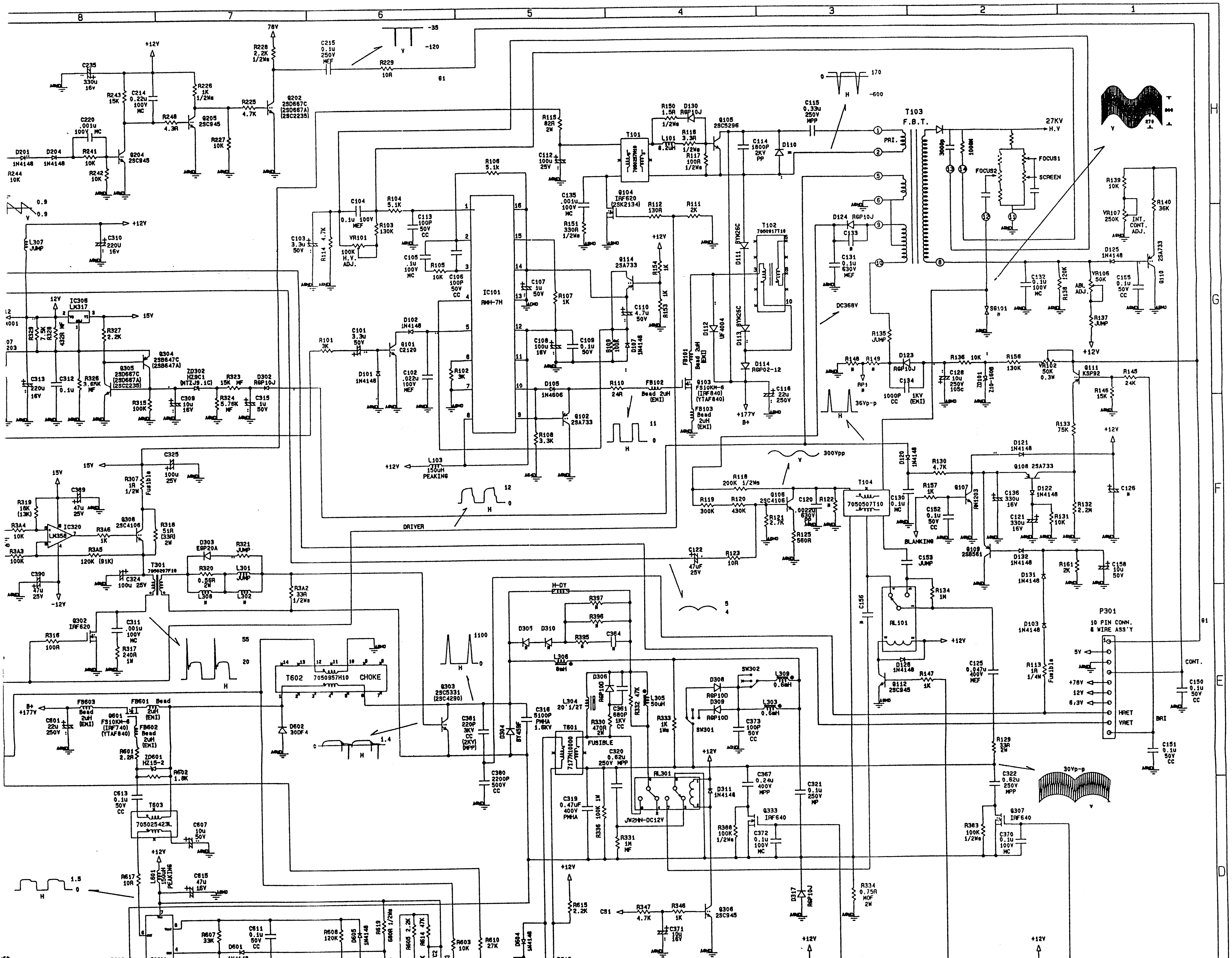
REF	PART NO	DESCRIPTION
[illegible]	RHT110244-V	NECK PCB ASS'Y
	2005095D10	HEAT SINK (C) FOR IC1
	3011100030	NUT ISO HEX M3 Z1NC FOR IC1
	4141117002	#P.C.B. VIDEO 196X123mm
	5290016000	TUBE-SHRINK ID=16¢ FOR R76,77
	5322220953	WIRE UL3239 AWG22 RED 70-10-10 FOR RCV
	8026113008	SCREW B/HD M3X8 TAPPING "B" FOR IC1 HEAT SINK & VIDEO PCB X2
	8504113010	SCREW BIND(+) M3X10 MACH W/DISK IC1
	C459430051	GND WIRE ASS'Y FROM NECK PCB TO NECK SHIELD (FRONT)
BP1	3340230165	BEAD PIN 16.5X2.3¢

REF	PART NO	DESCRIPTION
C1	5075104501	CAP-MEF 0.1UFJ 100V CF
C10	515X100T50	CAP-ECX 10UFM 50V -RT-
C12	515X109T50	CAP-ECX 1UFM 50V -RT-
C13	5156101T16	CAP-EC6 100UFM 16V -RT-
C14	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C15	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C16	7140104214	CAP-X7R 0.1UFM 100V -RT-
C17	515X100T01	CAP-ECX 10UFM 100V -RT-
C18	515X470S01	CAP-ECX 47UFM 100V -SF-
C19	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C2	5156109T01	CAP-EC6 1UFM 100V -RT-
C20	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C21	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C22	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C23	5156101T16	CAP-EC6 100UFM 16V -RT-
C24	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C25	5116472550	CAP-MC 0.0047UFJ 50V -RT-
C26	515X109T50	CAP-ECX 1UFM 50V -RT-
C27	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C28	5156101T16	CAP-EC6 100UFM 16V -RT-
C29	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C3	5075104501	CAP-MEF 0.1UFJ 100V CF
C30	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C31	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C32	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C33	5156100T50	CAP-EC6 10UFM 50V -RT-
C34	5156100T50	CAP-EC6 10UFM 50V -RT-
C35	5156100T50	CAP-EC6 10UFM 50V -RT-
C36	5156100T50	CAP-EC6 10UFM 50V -RT-
C37	5156109T50	CAP-EC6 1UFM 50V -RT-
C38	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C39	5121101552	CAP-CCCH 100PFJ 50V -RT-
C4	5075104501	CAP-MEF 0.1UFJ 100V CF
C40	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C41	5101222152	CAP-CCB 2200PFK 50V -RT-
C43	7140104214	CAP-X7R 0.1UFM 100V -RT-
C44	7140104214	CAP-X7R 0.1UFM 100V -RT-
C45	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C46	5156221T16	CAP-EC6 220UFM 16V -RT-
C47	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C48	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C49	5101102132	CAP-CCB 1000PFK 1KV -RT-
C5	5156109T01	CAP-EC6 1UFM 100V -RT-
C50	5101102152	CAP-CCB 1000PFK 50V -RT-
C54	5156109T50	CAP-EC6 1UFM 50V -RT-
C55	5134104452	CAP-SCF 0.1UFZ 50V -RT-
C57	5156109T50	CAP-EC6 1UFM 50V -RT-
C6	5156109T01	CAP-EC6 1UFM 100V -RT-
C7	5156100T50	CAP-EC6 10UFM 50V -RT-
C8	5104103463	CAP-CCF 0.01UFZ 1.5KV -SF-
C9	5104103463	CAP-CCF 0.01UFZ 1.5KV -SF-
CRT1	4570307T10	CRT SOCKET
D1	413258020U	DIODE BAV20 DO-35 -AT-
D11	413258020U	DIODE BAV20 DO-35 -AT-
D12	413258020U	DIODE BAV20 DO-35 -AT-
D13	413258020U	DIODE BAV20 DO-35 -AT-
D15	4120141480	DIODE 1N4148 (SI) -AT-
D16	4120141480	DIODE 1N4148 (SI) -AT-
D17	4120141480	DIODE 1N4148 (SI) -AT-
D18	4120141480	DIODE 1N4148 (SI) -AT-

REF	PART NO	DESCRIPTION
D10	4120141480	DIODE 1N4148 (SI) -AT-
D24	4325802001	DIODE BAV20 DO-35
D27	4325802001	DIODE BAV20 DO-35
D28	4120141480	DIODE 1N4148 (SI) -AT-
D29	4120141480	DIODE 1N4148 (SI) -AT-
D30	4120141480	DIODE 1N4148 (SI) -AT-
D31	4120141480	DIODE 1N4148 (SI) -AT-
D32	4120141480	DIODE 1N4148 (SI) -AT-
D33	4120141480	DIODE 1N4148 (SI) -AT-
D34	4120141480	DIODE 1N4148 (SI) -AT-
D35	4120141480	DIODE 1N4148 (SI) -AT-
D36	4120141480	DIODE 1N4148 (SI) -AT-
D37	4120141480	DIODE 1N4148 (SI) -AT-
FB1	4322209046	FERRITE BEAD 2UH -AT-
FB2	4322209046	FERRITE BEAD 2UH -AT-
FB3	4322209046	FERRITE BEAD 2UH -AT-
FB4	4322209046	FERRITE BEAD 2UH -AT-
FB5	4322209046	FERRITE BEAD 2UH -AT-
FB6	4322309006	FERRITE BEAD 3UH -AT-
FB7	4322309006	FERRITE BEAD 3UH -AT-
FB8	4322309004	FERRITE BEAD 3uH
FB9	4322309006	FERRITE BEAD 3UH -AT-
FT1	7096330175	NOISE FILTER
FT2	7096330175	NOISE FILTER
FT3	7096330175	NOISE FILTER
IC1	4159241900	IC ZM2419 41 PIN
IC2	4159128200	IC LM1282N 28PIN
IC3	4159393000	IC LM393 8PIN
IC4	4159623930	IC M62393P 20PIN
IC5	4159350432	IC MS5043-057SP 20PIN MASK
L1	4321338006	COIL PEAKING 0.33UH -AT-
L51	4321338006	COIL PEAKING 0.33UH -AT-
P1	4491200300	BASE 12P 2.54MM SXB-XH-A
Q1	4113904220	TRS BE422 TO-92
Q10	4111139040	TRS 2N3904 TO-92 RT
Q11	4111139040	TRS 2N3904 TO-92 RT
Q12	4116612030	TRS RN1203 RT
Q2	4113904220	TRS BE422 TO-92
Q3	4113904220	TRS BE422 TO-92
Q8	4116612030	TRS RN1203 RT
Q9	4111139040	TRS 2N3904 TO-92 RT
R1	4050524355	RES-CF 1/4W J 24K -AT- SMALL
R10	4060222115	RES-CC 1/2W K 220R -AT-
R11	4060247015	RES-CC 1/2W K 47R -AT-
R12	4060222115	RES-CC 1/2W K 220R -AT-
R13	4060210115	RES-CC 1/2W K 100R -AT-
R14	4060251315	RES-CC 1/2W K 51K -AT-
R15	4050518255	RES-CF 1/4W J 1.8K -AT- SMALL
R16	4050518255	RES-CF 1/4W J 1.8K -AT- SMALL
R17	4050518255	RES-CF 1/4W J 1.8K -AT- SMALL
R18	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R19	4257042321	RES-PR MF 1/4W F 2.32K AT SMAL
R2	4050510555	RES-CF 1/4W J 1M -AT- SMALL

REF	PART NO	DESCRIPTION
R20	4160220655	RES-MG 1/2W J 20M
R21	4050527155	RES-CF 1/4W J 270R -AT- SMALL
R22	4050539155	RES-CF 1/4W J 390R -AT- SMALL
R23	4050527155	RES-CF 1/4W J 270R -AT- SMALL
R24	4050539155	RES-CF 1/4W J 390R -AT- SMALL
R25	4050527155	RES-CF 1/4W J 270R -AT- SMALL
R26	4050539155	RES-CF 1/4W J 390R -AT- SMALL
R27	4050533055	RES-CF 1/4W J 33R -AT- SMALL
R28	4050533055	RES-CF 1/4W J 33R -AT- SMALL
R29	4050533055	RES-CF 1/4W J 33R -AT- SMALL
R3	4050512355	RES-CF 1/4W J 12K -AT- SMALL
R30	4257042401	RES-PR MF 1/4W F 2.4K AT SMALL
R31	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R32	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R33	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R34	4050510355	RES-CF 1/4W J 10K -AT- SMALL
R35	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R36	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R37	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R38	4257047509	RES-PR MF 1/4W F 75R AT SMALL
R39	4257047509	RES-PR MF 1/4W F 75R AT SMALL
R4	4050524355	RES-CF 1/4W J 24K -AT- SMALL
R40	4050533055	RES-CF 1/4W J 33R -AT- SMALL
R42	4257047509	RES-PR MF 1/4W F 75R AT SMALL
R43	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R44	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R45	4050510455	RES-CF 1/4W J 100K -AT- SMALL
R46	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R47	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R48	4050530455	RES-CF 1/4W J 300K SMALL -AT-
R49	4050547355	RES-CF 1/4W J 47K -AT- SMALL
R5	4050524355	RES-CF 1/4W J 24K -AT- SMALL
R50	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R51	4180215255	RES-FUSIBLE 1/2W J 1.5K -AT-
R53	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R54	4050510155	RES-CF 1/4W J 100R -AT- SMALL
R55	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R56	4050527455	RES-CF 1/4W J 270K SMALL -AT-
R57	4050515155	RES-CF 1/4W J 150R SMALL -AT-
R58	4050512455	RES-CF 1/4W J 120K -AT- SMALL
R59	4050522455	RES-CF 1/4W J 220K SMALL -AT-
R6	4050510555	RES-CF 1/4W J 1M -AT- SMALL
R60	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R61	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R64	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R65	4050547255	RES-CF 1/4W J 4.7K -AT- SMALL
R66	4050530255	RES-CF 1/4W J 3K -AT- SMALL
R67	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R68	4050510255	RES-CF 1/4W J 1K -AT- SMALL
R69	4050575255	RES-CF 1/4W J 7.5K -AT- SMALL
R7	4050512355	RES-CF 1/4W J 12K -AT- SMALL
R71	4050515255	RES-CF 1/4W J 1.5K SMALL -AT-
R73	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R74	4050515255	RES-CF 1/4W J 1.5K SMALL -AT-
R75	4050522255	RES-CF 1/4W J 2.2K -AT- SMALL
R76	4160220655	RES-MG 1/2W J 20M
R77	4160220655	RES-MG 1/2W J 20M
R79	4050539355	RES-CF 1/4W J 39K SMALL -AT-
R8	4050510555	RES-CF 1/4W J 1M -AT- SMALL
R9	4050512355	RES-CF 1/4W J 12K -AT- SMALL

Printed in Taiwan © 1996,08


8
7
6
5
4
3
2
1
H
G
F
E
D
78V
R228 2.2K 1/2Ws
C215 0.1u 250V MEF
R229 10R
-35
-120
V
61
+12V
C235 330u 16v
R243 15K
C214 0.22u 100V MC
R226 1K 1/2Ws
R225 4.7K
Q202 2SD667C (2SD667A) (2SC2235)
R248 4.3R
Q205 2SC945
R227 10K
C220 .001u 100V MC
D201 1N4148
D204 1N4148
R241 10K
Q204 2SC945
R242 10K
R244 10K
0.9
L307 JUMP
C310 220U 16V
IC306 LM317
15V
R329 7.5K
R328 432R MF
R327 2.2K
Q304 2SB647C (2SB647A)
Q305 2SD667C (2SD667A) (2SC2235)
ZD302 HZ9C1 (MTZJ9.1C)
R323 15K MF
D302 RGP10J
C313 220u 16V
C312 0.1u
R326 3.65K MF
R315 100K
C309 10u 16V
R324 5.76K MF
C315 1u 50V
C325 100u 25V
R307 1R 1/2W Fusible
C389 47u 25V
R319 18K (13K)
IC320 LM358
R3A4 10K
R3A3 100K
R3A6 1K
R3A5 120K (91K)
Q308 2SC4106
R318 51R (33R) 2W
C390 47u 25V
-12V
T301 7050297F10
C324 100u 25V
D303 EGP20A
R321 JUMP
R320 0.56R 2W
L301 JUMP
L308
L302
R3A2 33R 1/2Ws
Q302 IRF620
C311 .001u 100V MC
R316 100R
R317 240R 1W
55
20
DRIVER
R115 82R 2W
C112 100u 25V
R106 5.1k
C104 0.1u 100V MEF
R104 5.1K
C113 100P 50V CC
C103 3.3u 50V
R114 4.7K
R103 130K
VR101 100K H.V. ADJ.
C105 .1u 100V MC
R105 10K
C106 100P 50V CC
IC101 RMH-7H
R101 3K
C101 3.3u 50V
D102 1N4148
Q101 C2120
D101 1N4148
C102 .022u 100V MEF
R102 3K
L103 150uH PEAKING
C107 1u 50V
R107 1K
C108 100u 16V
C109 0.1u 50V
D105 1N4606
Q102 2SA733
R108 3.3K
T101 7050257H10
C135 .001u 100V MC
R151 330R 1/2Ws
Q104 IRF620 (2SK2134)
R112 130R
R111 2K
Q114 2SA733
R154 1K
R153 1K
C110 4.7u 50V
R109 100K
D107 1N4148
R110 24R
FB102 Bead 2uH (EMI)
FB101 Bead 2uH (EMI)
Q103 FS10KM-6 (IRF840) (YTAF840)
FB103 Bead 2uH (EMI)
R150 1.5R 1/2Ws
D130 RGP10J
L101 8.2uH
R116 3.3R 1/2Ws
R117 100R 1/2Ws
Q105 2SC5296
C114 1800P 2KV PP
D110
C115 0.33u 250V MPP
170
-600
D111 BYW26C
T102 7050917T10
D112 UF4004
D113 BYW26C
D114 RGP02-12
C116 22u 250V
+177V B+
DC368V
T103 F.B.T.
PRI.
27KV H.V
3000p
100M
FOCUS1
SCREEN
FOCUS2
D124 RGP10J
C133
C131 0.1u 630V MEF
S6101
R139 10K
VR107 250K INT. CONT. ADJ.
R140 36K
D125 1N4148
Q110 2SA733
C132 0.1U 100V MC
R138 120K
VR106 50K ABL ADJ.
C155 0.1u 50V CC
R137 JUMP
R135 JUMP
R148
R149
RP1
D123 RGP10J
C134 1000P CC 1KV (EMI)
R136 10K
C128 10u 250V 105c
ZD101 Z10-1608
R156 130K
VR102 50K 0.3W
Q111 KSP92
R145 24K
R146 15K
R133 75K
36Vp-p
300Vpp
R118 200K 1/2Ws
R119 300K
R120 430K
Q106 2SC4106
C120 .0022U 630V PP
R122
R121 2.7K
R125 560R
T104 7050507T10
C130 0.1u MC
D120 1N4148
R130 4.7K
R157 1K
C152 0.1u 50V CC
Q107 RN1203
BLANKING
D121 1N4148
Q108 2SA733
D122 1N4148
C136 330u 16V
C121 330u 16V
R131 10K
R132 2.2M
C126
C122 47uF 25V
R123 10R
C153 JUMP
Q109 2SB561
D132 1N4148
D131 1N4148
R161 2K
C158 10u 50V
R134 1M
C156
RL101
D103 1N4148
+12V
D126 1N4148
Q112 2SC945
R147 1K
C125 0.047u 400V MEF
R113 1R 1/4W Fusible
P301 10 PIN CONN. & WIRE ASS'Y
5V
+78V
12V
6.3V
HRET
VRET
CONT.
BRI
C150 0.1u 50V CC
C151 0.1u 50V CC
R129 33R 2W
30Vp-p
C322 0.62u 250V MPP
Q307 IRF640
R383 100K 1/2Ws
C370 0.1u 100V MC
H-DY
R397
R396
D305
D310
R395
C364
L306 8mH
1100
Q303 2SC5331 (2SC4290)
C381 220P 3KV CC (2KV) (MPP)
D304
BY459F
C316 5100P PMHA 1.6KV
C380 2200P 500V CC
T602 7050957H10 CHOKE
D602 30DF4
1.4
D306 RGP100
L304 20'1/2T
C361 680P 1KV CC
R332 47K
L305 50uH
R330 470R 2W
T601 7177H10000
FUSIBLE
C320 0.62u 250V MPP
C319 0.47uF 400V PMHA
R336 100K 1W
R331 1M MF
RL301
JW2HN-DC12V
R333 1K 1Ws
SW301
SW302
D308 RGP10D
D309 RGP10D
L309 0.6mH
L303 0.6mH
C373 100P 50V CC
D311 1N4148
C367 0.24u 400V MPP
C321 0.1u 250V MP
Q333 IRF640
R388 100K 1/2Ws
C372 0.1u 100V MC
D317 RGP10J
R334 0.75R MOF 2W
R615 2.2K
CS1
R347 4.7K
R346 1K
C371 10u 16V
Q306 2SC945
B+ +177V
FB603 Bead 2uH (EMI)
FB601 Bead 2uH (EMI)
C601 22u 250V
Q601 FS10KM-6 (IRF740) (YTAF840)
FB602 Bead 2uH (EMI)
R601 2.2R
ZD601 HZ15-2
R602 1.8K
C613 0.1u 50V CC
T603 705025423L
C607 10u 50V
L601 150uH PEAKING
C615 47u 16V
R617 10R
1.5
R607 33K
D601 1N4148
C611 0.1u 50V CC
R608 120K
D605 1N4148
R619 680R 1/2Ws
R605 2.2K
R614 47K
R603 10K
R610 27K
D604 1N4148

DATE	ECN/ECO NO.
07-08-'96	0-070596C2ET
07-08-'96	0-070596C1ET
07-08-'96	0-07059601ET
07-16-'96	0-07159601E0
07-16-'96	0-07159602ET
07-16-'96	0-07159603ET
07-23-'96	0-07199601ET
07-23-'96	0-07199602ET
07-23-'96	0-07199603ET
08-08-'96	0-08069601RT
08-08-'96	0-080596C3RT
03-09-'96	0-071996C1RT
08-09-'96	0-08089601ET
08-12-'96	0-071996C2RT

16 15 14 13 12 11 10 9

G F E D

TO VIDEO

P303 10PIN CONN. & WIRE ASS'Y

SDA/O CLK/O CS/O SCL/I SDA/I

SDA SCL

+5V

R801 51R R802 4.7K R803 4.7K R804 100R ZD801 HZ3C2 (MTZJ3.3A) Q801 2SC945 Q802 2SC945 C801 1u 50V

R806 2K C802 0.1u 50V CC

IC805 74HC86

D815 1N4148 R807 750R C817 680P 50V CC

H HS V VS

IC805 74HC86 R805 7.5k C803 0.1u 50V CC C816 100P 50V CC C815 100P 50V CC

DEG CS1

RN802 R-NET 4.7K COMMON9P

RN803 R-NET 4.7K COMMON7P

PW03 (STAND BY)

IC801 XC68HC705B5P

PWM2* H-PHASE PWM1* V F-V PWM0* H F-V RESET VDD VSS XTAL EXTAL PB5* SCAN_1 PB4* SCAN_2 PB3* I_SDA PB2* I_SCL PB1 DECR PB0 INCR IRQ /VPP PA7 PA6 PA5 PA4 PA3 VSYNC HSYNC PWM3* PWM4* PWM5* PWM6* PWM7* PWM15 PWM14 PWM13* PWM12* PWM11* PWM10* PWM9* PWM8* PD1/SCL PD0/SCL PA0 PA1 PA2

V-POSITION CF H-SIZE V-SIZE TILT SOG PIN-CUSHION TRAP PIN-BALANCE PARALELOGRAM SCL\E SDA\E

C805 0.1u 50V CC C804 100u 10V SMALL C806 39p 50V CC X801 4MHz C807 39p 50V CC R806 4.7K MUTING

SDA\O CLK\O CS\O PWG3 PWG1 SDA\O CLK\O CS\O SCL\I SDA\I

Q203 2SC945 R231 510R R232 10K

LD201 LT6463-23

R233 1K C813 R815 4.7K R814 4.7K

D812 1N4148 S801 CONTRAST
D814 1N4148 S802 BRIGHTNESS
D810 1N4148 S803 ENTER
D813 1N4148 S804 RECALL
D816 1N4148 S805
D817 1N4148 S806

C812

R823 4.7K R820 R819

CS3 CS2 BLANKING

R212 36K R213 36K C207 10u 16V R214 470K -12V R216 8.25K MF C208 4.7u 50V C230 1000P 50V CC C225 0.1UF 100V MC D202 1N4001 C209 470u 25V C210 220u 35V R230 1R 2W 15V

IC201 TDA8172 -12V C211 470u 25V C212 0.22u 100V R220 1.2R R221 470R 1/2W V-DY C213 .0033u 100V MC D201 1N4148 R244 10K R219 47.5K MF C222 820P 50V CC D203 R223 1.5R 1W R218 R224 15K MF C226 2.2u 50V R235 91K

C227 1u 50V R246 95.3K MF R247 169K MF C231 .0012u 100V MC R202 10K C221 0.1u 50V CC R205 11K C334 0.1u CC R204 750K C204 4.7u 50V C218 .47u MD R203 10K C232 0.1u MC R236 15K MF

IC302 LM1295

24 +V DRIVE 23 -V DRIVE 22 A-VERT 21 A-VERT 20 OSC CAP 19 2F CAP 18 ALC CAP 17 GND 16 V-DYNA FOCUS 15 V-DYNA FOCUS CTRL 14 H-DYNA CTRL 13 H-BOW CTRL

GND 1 V HEIGHT 2 +V CAP 3 V SYNC/I 4 -V CAP 5 V-DYNA HEIGHT 6 Vcc 7 Vref CAP 8 H-DYNA WIDTH 9 FOCU CTRL 10 H-TRAP CTRL 11 H-PARA CTRL 12

R210 10K R206 1K C206 10u 16V C201 0.1u 50V CC R238 680R C224 1u 50V R291 1K C202 10u 16V R245 75K C203 100u 16V R207 20K C216 470u 16V C217 100u 16V R3A9 25.5K MF R234 84.5K MF R240 220K R239 13K C234 10u 16V C303 0.1u CC R237 8.2K C335 0.1u CC C336 0.1u CC R303 25.5K MF

R356 10K R357 36K R354 10K C339 10u 16V R350 4.7K C338 10u 16V R351 10K R348 4.7K C333 10u 16V R348 68K C332 10u 16V R311 10K R353 1K R312 10K R367 13K R358 220R C369 0.1u 50V CC R368 8.2K C307 .0022u MC C330 .01u 50V CC C314 47u 16V R359 560K R310 2.2K

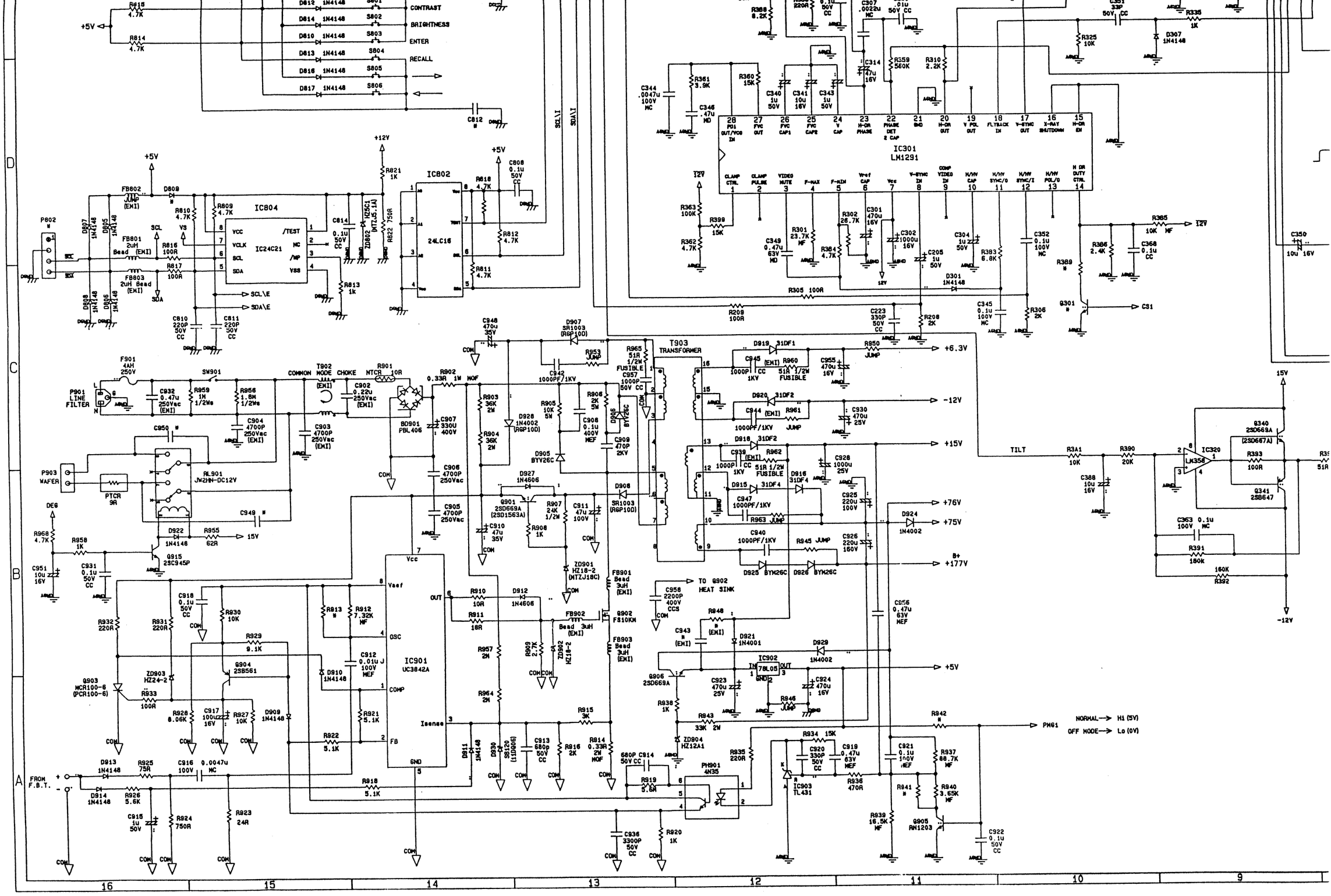
C344 .0047u 100V MC R361 3.9K C346 .47u MD R360 15K C340 1u 50V C341 1u 16V C343 1u 50V

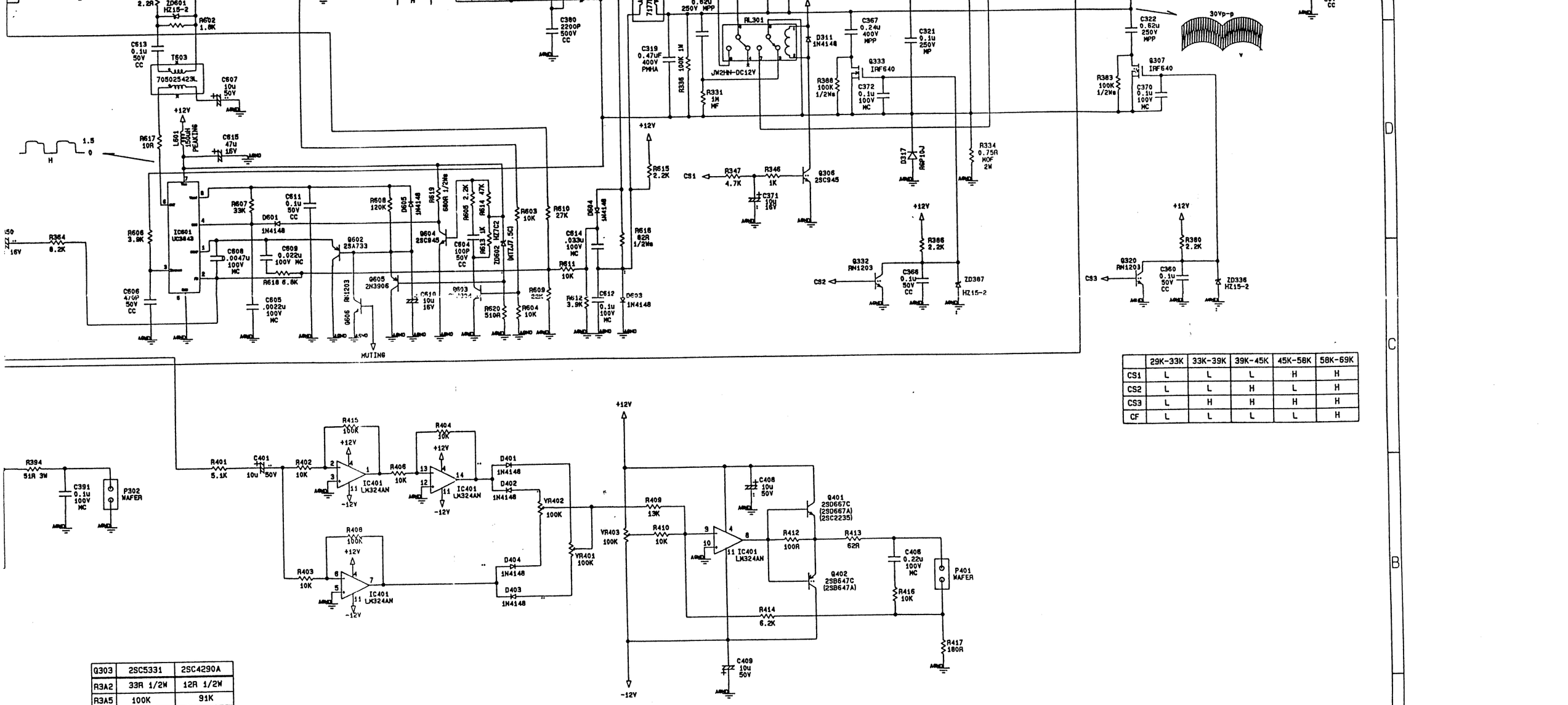
IC301 LM1291

28 FOI OUT/VCO IN 27 FVC OUT 26 FVC CAP1 25 FVC CAP2 24 V CAP 23 H-DR PHASE 22 PHASE DET & CAP 21 GND 20 H-DR OUT 19 V POL OUT 18 FLYBACK IN 17 V-SYNC OUT 16 X-RAY SHUTDOWN 15 H-DR EN

R3A8 100K Q206 2SC945 R304 18K R355 47K R366 R368 4.7K R369 1K C347 10u 16V C348 10u 16V C353 0.1u 100V MC R371 100R Q311 2SC945 Q312 2SA733 R379 10K C351 33P 50V CC R335 1K R325 10K D307 1N4148

12V D312 1N4001 Q207 RN1203 R319 10K (13K) R3A4 10K R3A3 100K


CONTRAST
BRIGHTNESS
ENTER
RECALL
IC804
IC24C21
24LC16
IC802
IC301
LM1291
T903
TRANSFORMER
IC901
UC3842A
IC902
78L05
IC903
TL431
IC320
LM358
PH901
4N35
RL901
JW2H-DC12V
P901
LINE FILTER
P903
WAFER
PTCR
9R
P802
FROM F.B.T.
TO Q902
HEAT SINK
TILT
NORMAL→ Hi (5V)
OFF MODE→ Lo (0V)
PM61
+6.3V
-12V
+15V
+76V
+75V
B+
+177V
+5V
-12V
+12V
15V
SCL
SDA
SCL\E
SDA\E
CS1
I2V



	29K-33K	33K-39K	39K-45K	45K-58K	58K-69K
CS1	L	L	L	H	H
CS2	L	L	H	L	H
CS3	L	H	H	H	H
CF	L	L	L	L	H

Q303	2SC5331	2SC4290A
R3A2	33R 1/2W	12R 1/2W
R3A5	100K	91K
R320	0.56R/2W	0.24R/2W
R318	51R/2W	120R/2W
R319	15K	18K
R3A6	100R	1K
L304	708S207H10	708S206301
L301	JUMP	5.6UH
L302	JUMP	5.6UH

CAPETRONIC (KAOHSIUNG) CORP.				
DRAWING DATE	TOLERANCE		SCALE	UNIT
08-12-'96	DIM +	ANGLE -	/	
DRAWER	SHEET		DRAWING NAME	FILE NAME
LIN	OF		ALL IN ONE	RH7T1X1A
MODULE NO. RMH-7T1X				

8 7 6 5 4 3 2 1